MACHINERY

NOVEMBER 5, 1958 ONE SHILLING & THREEPENCE

For low production costs . . .

ARCHDALE
MEDIUM DUTY
HIGH SPEED RADIALS

17 SPINDLE SPEEDS 15 TO 1,500 R.P.M.
6 OR 12 FEEDS
NORMAL DRILLING CAPACITY 3ins. DIA. IN MILD STEEL
SIZES RANGE FROM 4ft. TO 8ft. SPINDLE RADIUS

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LEDSAM ST., BIRMINGHAM, 16
A MEMBER OF THE STAVELEY COAL & IRON CO. LTD. GROUP
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Phone: COVENTRY 89221

'MACHINERY' NATURAL COLOUR PHOTOGRAPH by courtesy of **THE GENERAL ELECTRIC CO. LTD., WEMBLEY**

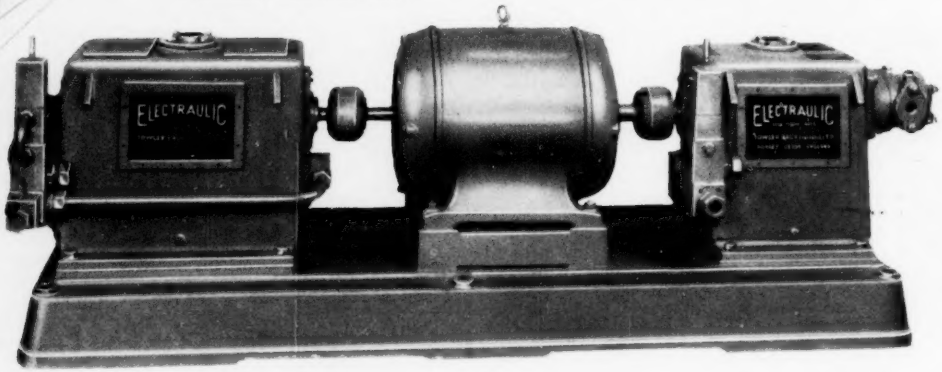
CONTINUOUS PERFORMANCE

HOW MUCH PRESSURE CAN A GOOD PUMP STAND?

As much as 7,000 p.s.i., and on a continuous duty basis if it is an " Electraulic " In-Line Plunger Pump.

Volumetric efficiency is consistently maintained at 96 to 98 per cent.

The rugged all-steel construction of an " Electraulic " Pump combined with its design principles, ensures smoothness, efficiency and reliability.



and here's how!

The high speed motion of the pump plungers operating on a very short stroke at 1,500 r.p.m., ensures low impulse delivery. The blanket of oil contained in the heavy steel housing lubricates all moving parts and smothers mechanical sound.

The poppet type valves function without slip or cavitation, the plungers have a long precision fit in their cylinder bores. The net volume output is practically the same at " maximum pressure " as at " no pressure ".

Enables the press ram performance to be accurately predicted. There is virtually no valve slippage and the pump output does not change with variation in oil temperatures nor fluctuation in pressure.

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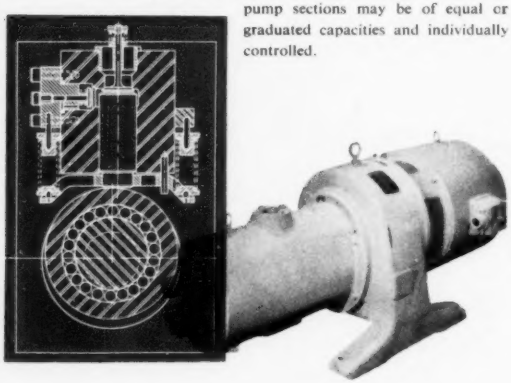
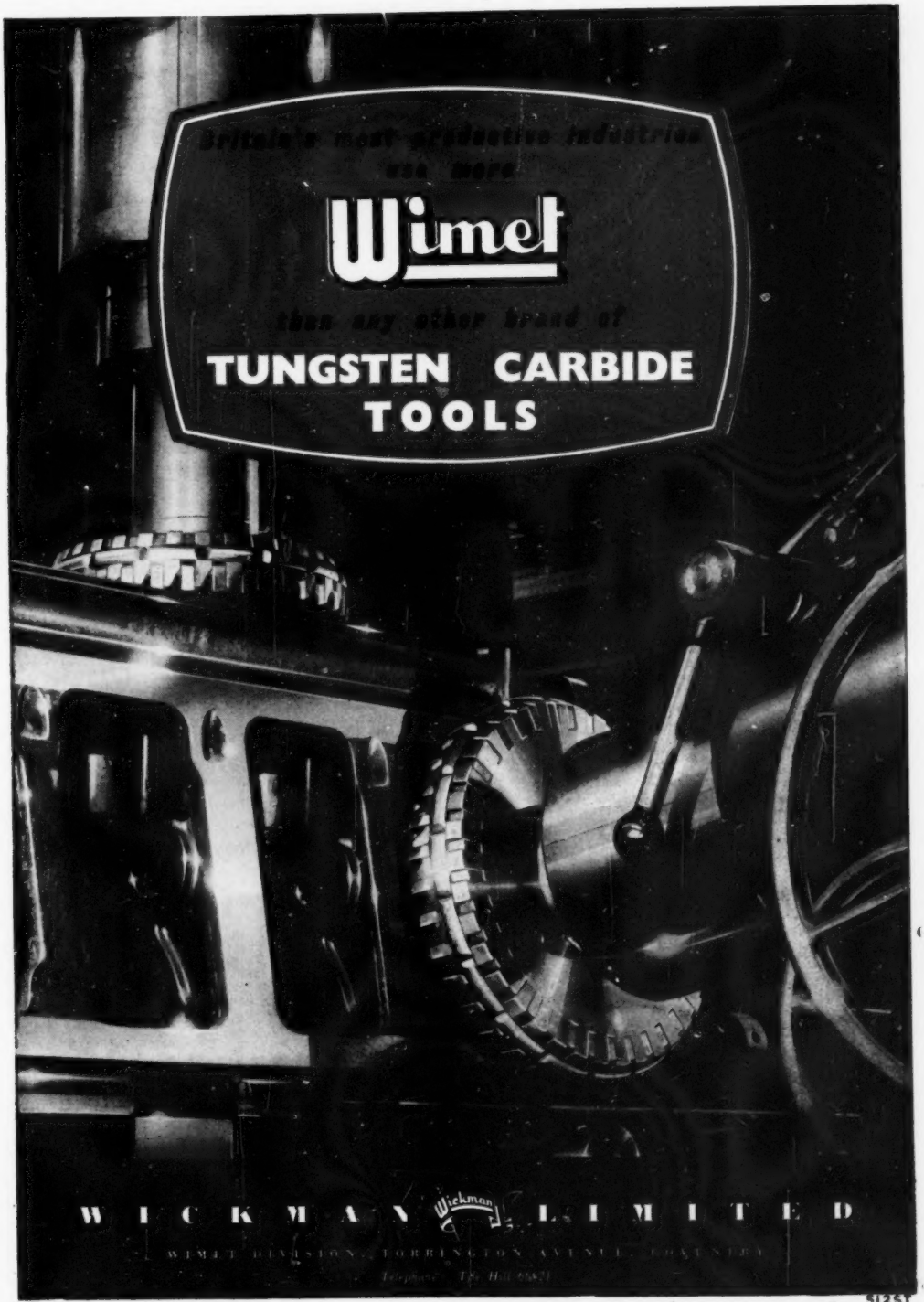


" Electraulic " Power Unit of double and single pumps, driven by a single motor. Individual pump sections may be of equal or graduated capacities and individually controlled.

Either single or double pump sections may be fitted to this type of alternative mounting.

ELECTRAULIC
REGD. TRADE MARK
IN-LINE PLUNGER PUMPS

TOWLER BROTHERS (PATENTS) LIMITED
RODLEY, NR. LEEDS, ENGLAND
Tel: Pudsey 3125/6/7/8 Grams: 'Electrolic' Rodley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TWO AND FOUR-POINT-PRESSES
DOUBLE ACTION PRESSES
FRICTION-SCREW PRESSES
DOUBLE SPINDLE DRAWING PRESSES FOR COLD AND HOT FORMING
GEARED KNUCKLE JOINT COINING PRESSES
DIEING MACHINES
SPECIAL PRESSES
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STAMPING DIES
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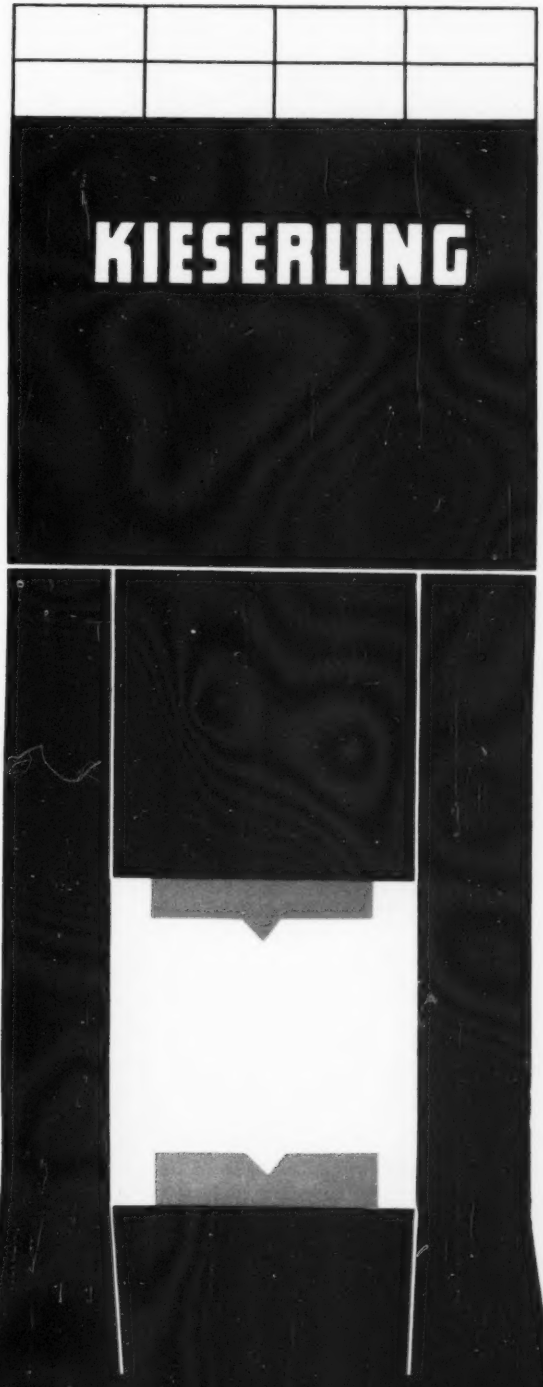
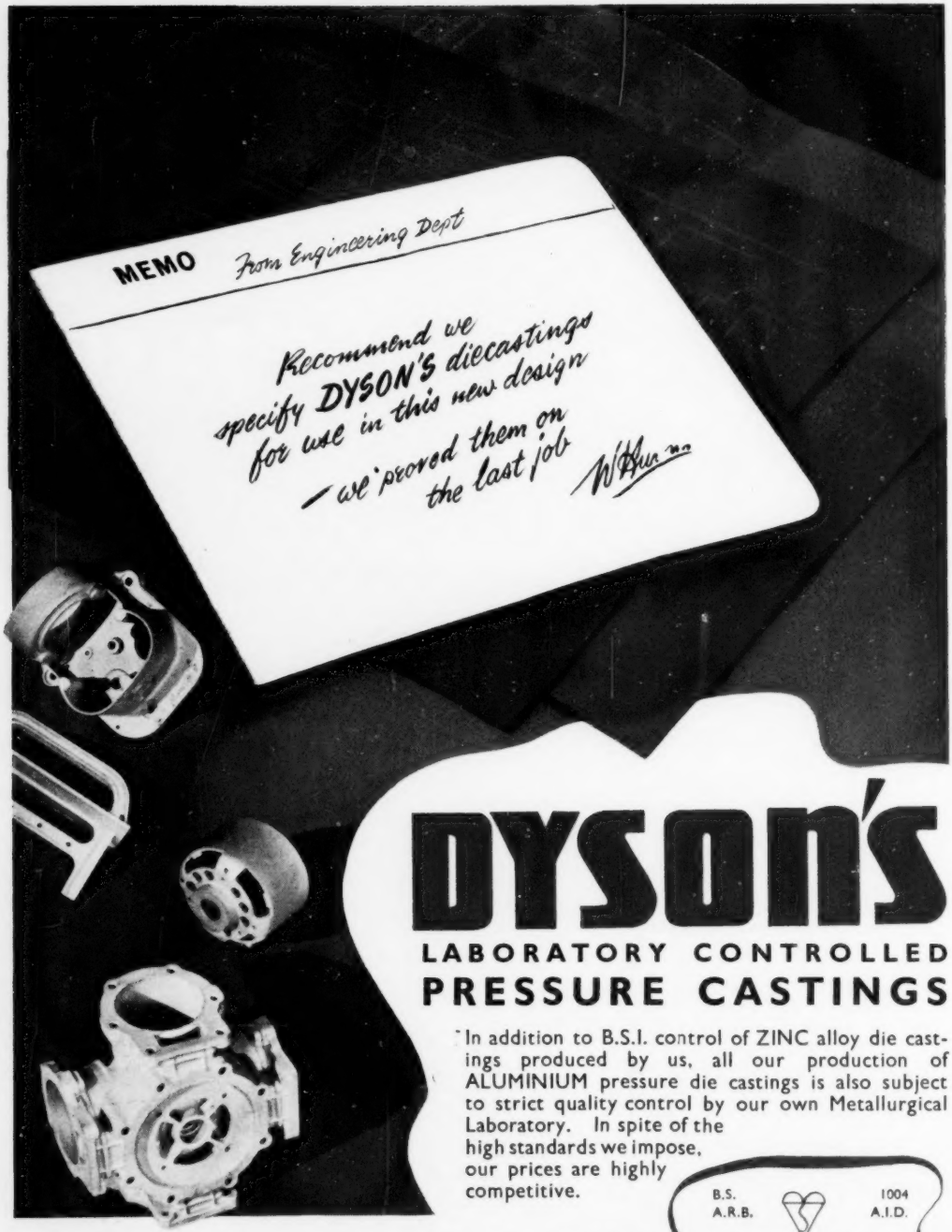
PRESSING DIES
FOLLOW-ON DIES
SETS OF DIFFERENT DIES

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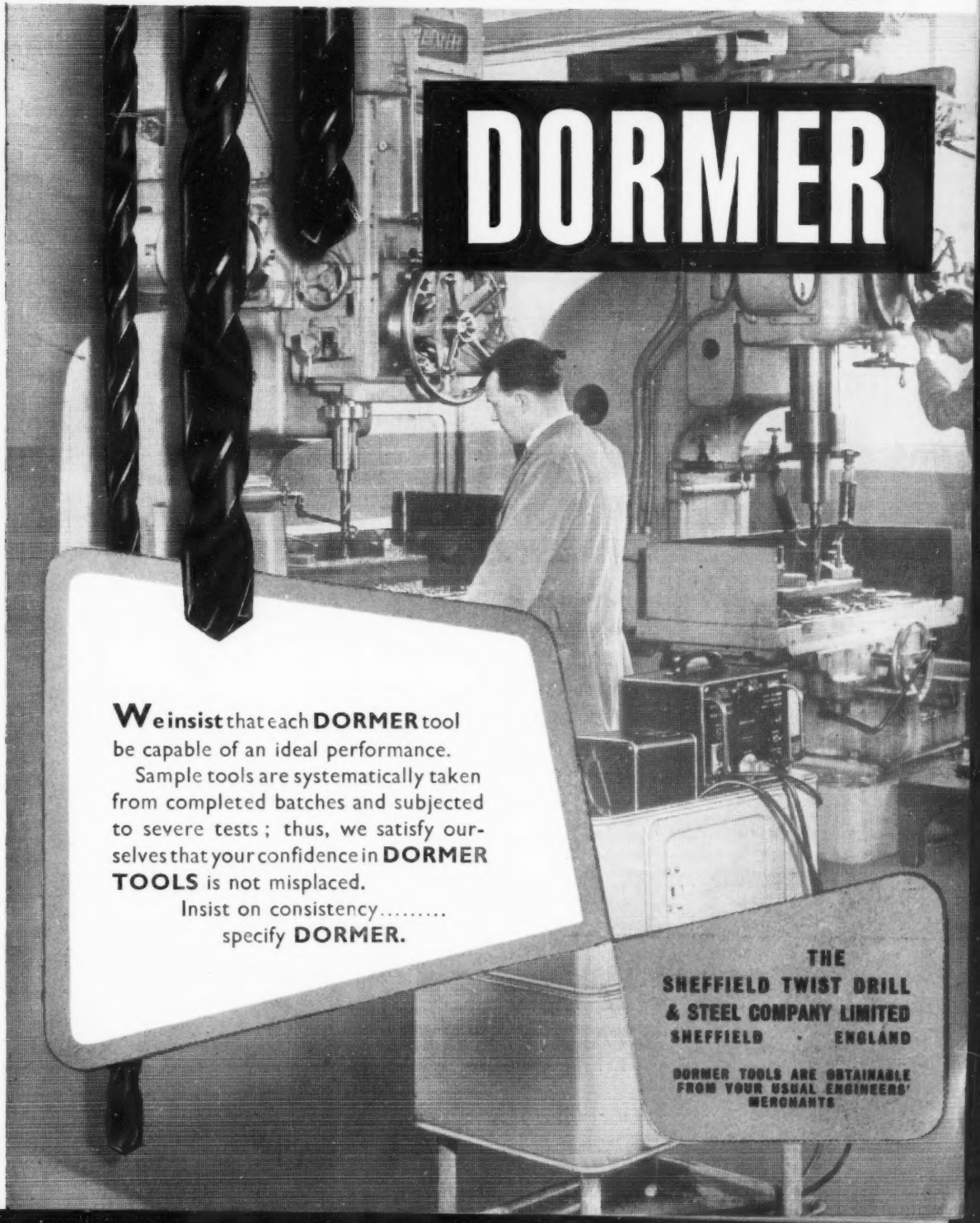

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Sample tools are systematically taken from completed batches and subjected to severe tests; thus, we satisfy ourselves that your confidence in **DORMER TOOLS** is not misplaced.

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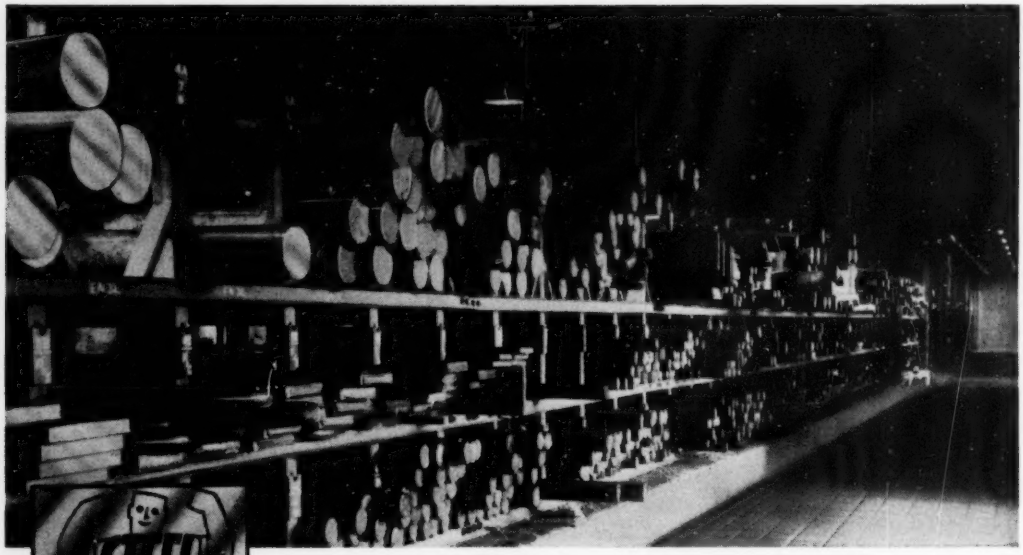

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MR. STEEL'S NEW WAREHOUSE FOR CARBON & ALLOY STEELS

Macready's Metal Company Ltd. has this additional special warehouse at King's Cross devoted to the supply of Carbon and Alloy Steels.
Very large stocks are held and the warehouse is completely equipped with the modern facilities required to maintain the quick delivery service for which Macready's are famous. Production delays are eliminated when you use Macready's.

5000 TONS OF BRIGHT STEEL are always available at our main warehouse at Usaspead Corner for immediate delivery. Avoid delays by using the Macready service.

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METAL COMPANY LIMITED
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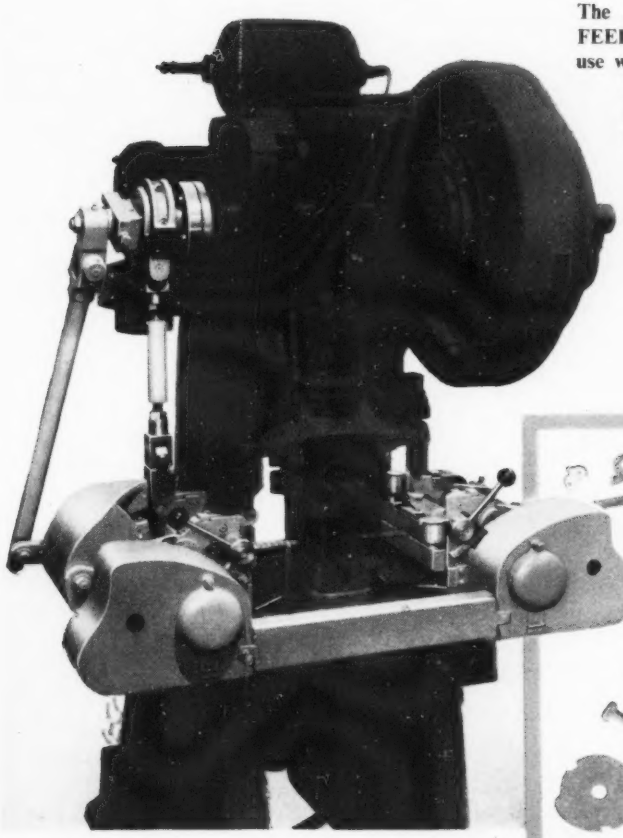
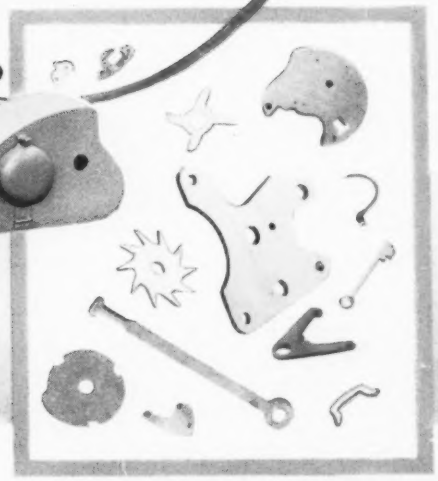
Telephone : TERminus 7060 (20 lines). Telegrams : Usaspead, London, Telex. Telex No. 22788

HME



The AUTOMATIC COIL FEED ATTACHMENT for use with the 'OP' range of H.M.E. open front presses is a self-contained unit which can be fitted to the machine without difficulty and quickly removed and stored when not required.



Coil Feed Attachments are available for use with all model 'OP' presses from 20 to 100 tons capacity.

Write for Catalogue No. 12.

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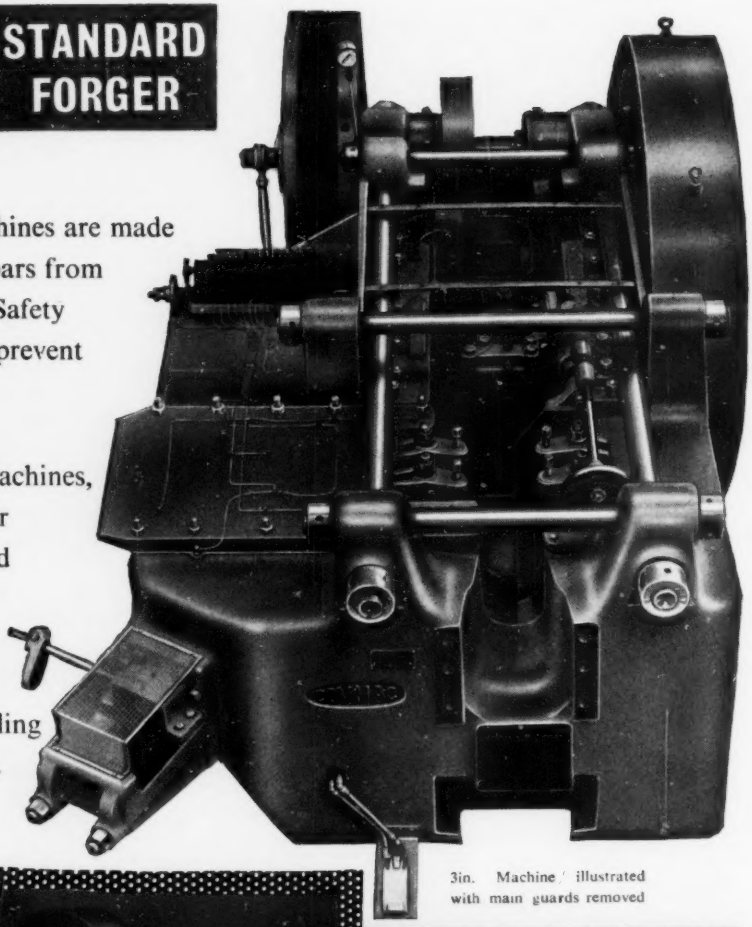
COVMAC STANDARD FORGER

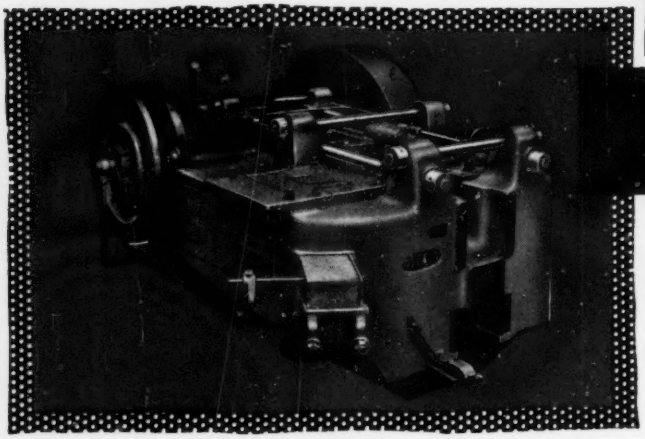
Covmac Forging Machines are made in eight sizes to take bars from 1in. to 6in. diameter. Safety devices on all models prevent overloading.

Covmac also make Automatic Forging Machines, as well as machines for making balls up to and including 4ins. diameter.

In addition there are three sizes of Hot Milling and Sawing Machines.



3in. Machine illustrated with main guards removed



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SG3H PRECISION

HYDRAULICALLY OPERATED

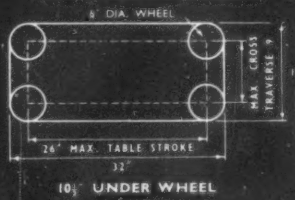
RAPID POWER ELEVATION OF KNEE

HIGH PRODUCTION WITH VERSATILITY

SENSITIVE CONTROLS WITH RUN OUT TO LOADING POSITION

ACCURACY TO ·0001 WITH PERFECT FLATNESS AND FINISHES TO 1·5 MICRO INCHES ON SUITABLE MATERIAL

TABLE WORKING SURFACES



This latest development model SG3H is "the" Machine for rapid Surfacing in the Toolroom or Production Shop.
Detachable Spindles are available for deep and intricate work.

Hydraulic Control allows the operator to "inch" the Table along or stop instantaneously in any position at will.

Auto Run-out of Table to loading position.

Built in Coolant system with separation unit in Base.

Uses 6" Diameter Cylinder Wheels for faster Surfacing and Maximum wheel economy.

ABWOOD MACHINE TOOLS LTD., PRINCES ROAD, DARTFORD, KENT

Telegrams : ABWOOD DARTFORD

SG-1

Machinery Nov. 5, 19

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MEEHANITE castings keep costs down

All castings, even the cast-to-form dies, in this Butterley Press are made from Meehanite Iron.

Heavy duty machine tool castings in Meehanite offer cost-cutting advantages such as:—

- ★ Absolute soundness under pressure.
- ★ Close-grained, homogeneous texture, giving high surface finish.
- ★ Good machinability and absence of hard spots.
- ★ Faster speeds and feeds.

Each grade of Meehanite offers special properties —wear resistance, heat resistance, corrosion resistance and ready response to heat treatment. Meehanite Castings meet B.S.S. 1452, Grades 10 to 26.

Ask one of these Foundries for a copy of "Meehanite in the Service of Industry".

Cast Iron Can Do it-if it's

MEEHANITE

The Dependable Metal

Meehanite Metal Foundries at your service

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WORM REDUCTION DRIVE PLANING MACHINE

At last!
-- a low priced machine with a high priced machine's performance

planers
HUDDERSFIELD · LIMITED

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What are you doing about hole grinding?

The British built

BRYANT No. 1109

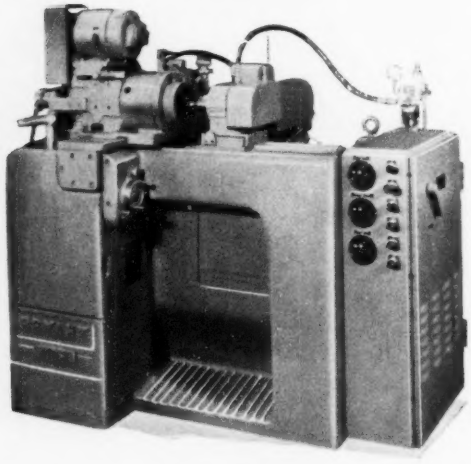
PRECISION INTERNAL GRINDER

TOTAL CHUCK SWING 9in.

MAX. DEPTH HOLE 3½in.

MAX. TRAV. STROKE 6in.

MAX. BORE DIA. 3in.



WORKHEAD ADJUSTABL TO 45°

WILL GRIND UP TO 90°

INCLUDED ANGLE

will give you TENTHS precision at high production rates

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designed to give the greatest accuracy for parallelism and roundness

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arranged for high frequency wheelheads - - - belt drive wheelheads - - - - or both

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BRANCHES — ALPERTON · BIRMINGHAM · MANCHESTER · LEEDS · GLASGOW

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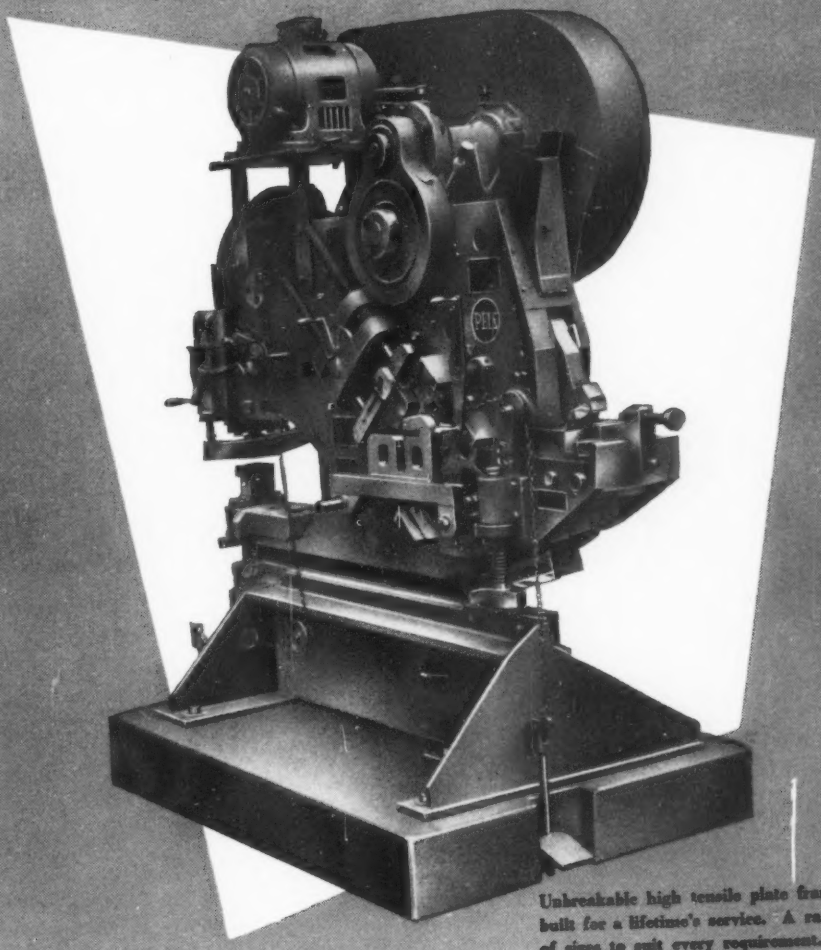
Universal Steelworker

PUNCHING, SHEARING, CROPPING AND NOTCHING



Unbreakable high tensile plate frame, built for a lifetime's service. A range of sizes to suit every requirement.

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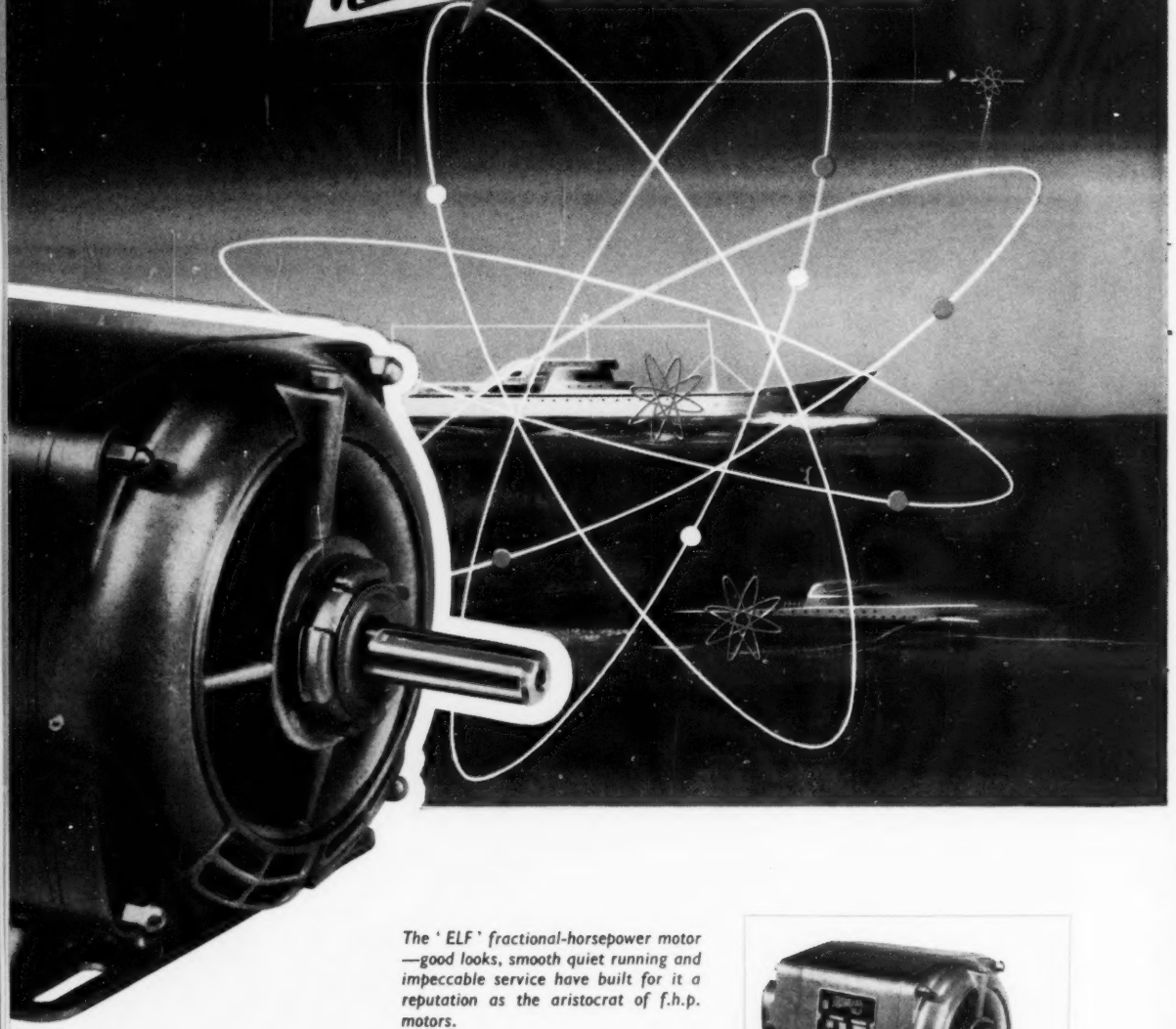
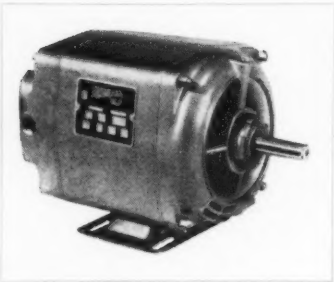
IN STEP WITH PROGRESS



The 'ELF' fractional-horsepower motor —good looks, smooth quiet running and impeccable service have built for it a reputation as the aristocrat of f.h.p. motors.

Elf motors—specially "tailored" for each range of applications—are used extensively in the domestic appliance, oil burner and general engineering industries.



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Newman

making the pace in motor progress

NEWMAN INDUSTRIES LIMITED, YATE, BRISTOL

3K essential features...

RIGIDITY · SPEED OF OPERATION · ACCURACY

These three features are incorporated in this medium-size machine for rapid precision boring. Rigidity is plainly visible in the planer-type design and rugged construction. Speed of operation is ensured by the GSIP indexing method and a wide range of spindle speeds and feeds. The built-in measuring screws eliminate the use of gauge blocks, dial indicators or micrometers and the tedious combination of these to make up the desired dimensions. For accuracy, direct-reading divided drums provide rapid and accurate placing of holes, the centre-distances of which are read to

0.00005 inch or 0.001 mm.

Extraordinarily versatile, this machine can be used for jig and tool work, die making development work and direct production.

The installation and service of this machine is carried out by the Area Engineers at Sogenique (Service), Ltd., under the G S I P guarantee.

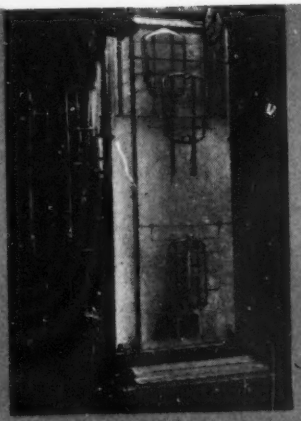
Please write for literature or further information

MP-3K

Longitudinal travel of table	18 in.—450 mm.
Transverse travel of spindle saddle	14 in.—350 mm.
Distance from table top to spindle max.	20½ in.—520 mm.
end (retracted) min.	4¾ in.—120 mm.
8 spindle speeds 75—125—210—340—480—770—1250—2000 rpm.	
GUARANTEED ACCURACY FOR ALL DISPLACEMENTS OF THE WORK-TABLE AND SPINDLE SADDLE ...	*0.00015 in.—0.004 mm.*

Société Genevoise Ltd.

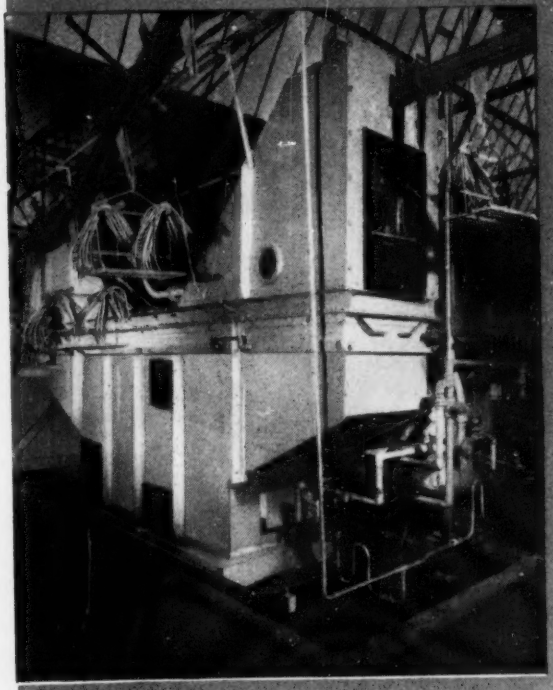
NEWPORT PAGNELL · BUCKS TELEPHONE 460/1/2



1933

Morris Motors Ltd. installed one of the first-ever continuous I.C.I. metal degreasing plants. This was arranged for degreasing radiator shells, hub caps, etc. after polishing, and provided liquor, vapour and jetting treatment with trichloroethylene. After 24 years this plant continues to give excellent service, degreasing approximately 30,000 assorted articles per week.

One good plant sells another



1956

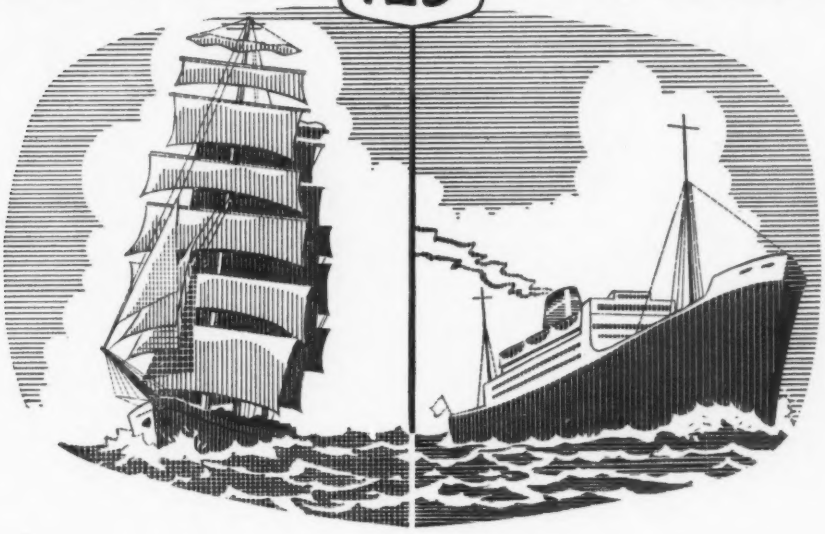
After many years' practical experience in the design and construction of continuous plants, I.C.I. supplied a second plant, fitted with a monorail conveyor to link up with the Firm's production line, and arranged for boiling liquor treatment to remove polishing compound from motor car windscreen and window frames. After leaving the plant, stainless steel parts are packed for despatch while those in brass and mild steel pass to the painting shop.

The new plant in service.
For advice on metal degreasing problems, consult

IMPERIAL CHEMICAL INDUSTRIES LTD., ICI **LONDON, S.W.1**

BP.253

AFTER 125 YEARS



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still demand
COATED ABRASIVES
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ESTABLISHED

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OA88A

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"What is it that you like most about REISHAUER?"

"Two things—remarkably high production and simplicity of setting and control."

"Do you get burning of the tooth-flank on the REISHAUER?"

"We did at first but found it was entirely our own fault through using the wrong types of grinding wheel."

"You grind on batch production but what happens if you have to grind a highly accurate gear?"

"No trouble on the REISHAUER—as a matter of fact we've ground master gears on the machine."

"You are gear grinding specialists and have added a REISHAUER ZA to a shop already filled with gear grinders. What then would be your advice to a firm who have not a single gear grinder and are wondering which would be the best choice to make?"

"You just couldn't better the REISHAUER. It is so universal and look at the high helix angle (45°) it will accommodate!"

"I understand that tip and root relief are obtainable on the REISHAUER. Is it very complicated to arrange?"

"On the contrary—the required amount is put on the cam or template in the dressing device and it stays put until the job's done."

"When you get the combination of coarsest D.P. and greatest helix angle do you get trouble with the grinding wheel producing the correct result?"

"We have in fact had this trouble but it was remedied by employing a compensated wheel form."

SWISS
REISHAUER
GEAR GRINDERS
FOR SPUR & HELICAL GEARS
NZA for gears ¾" to 11¾" diameter, 5 DP.
ZB for gears up to 27½" diameter, 3½ DP.

Record of an actual conversation between a Reishauer user and a prospective purchaser.

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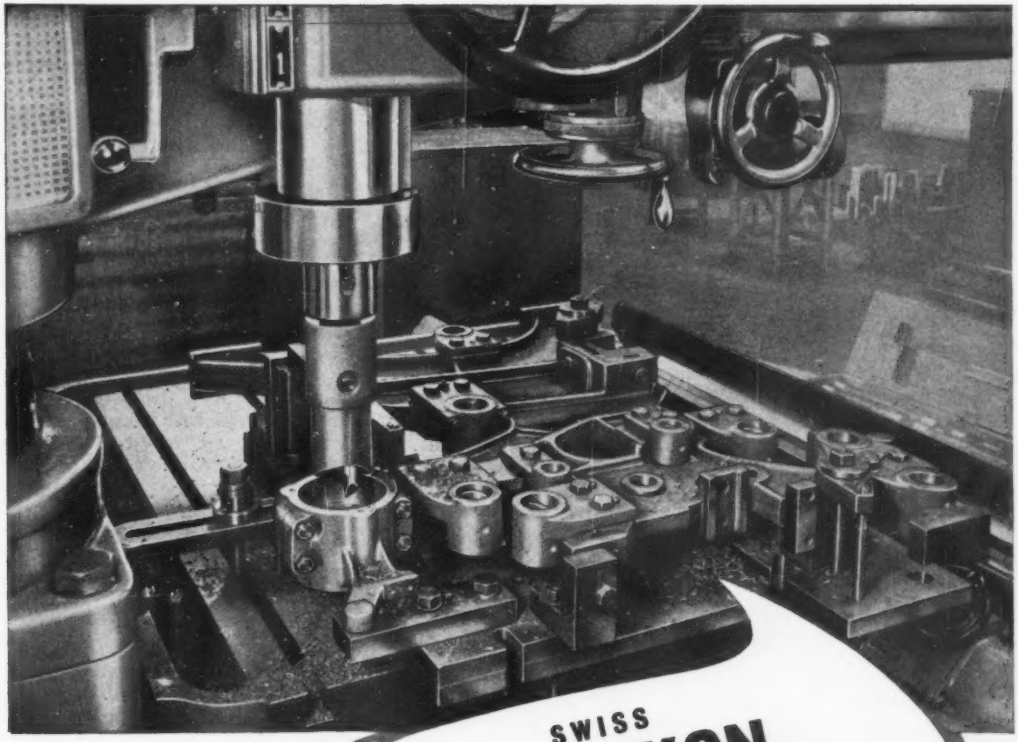

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OERLIKON

Production Jig Borer

Heavy duty yet sensitive.
Double columns for extra rigidity.
Electro-magnetic quill clamping with finger-tip control. 18 spindle speeds, 15 feeds. 2-speed quick traverse.

3 models:
58⅝", 66" or 89⅝" between columns.
Table traverses 42½" or 47¼".

brings
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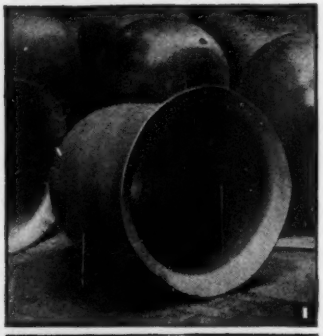
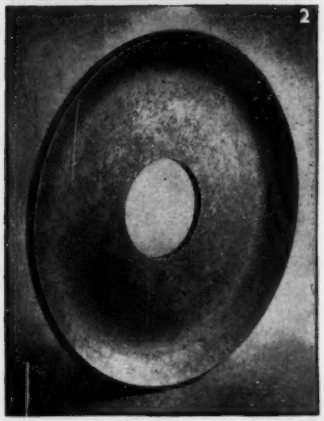
139





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HARPER MEEHANITE CAST-TO-FORM TOOLS

for their high grade presswork

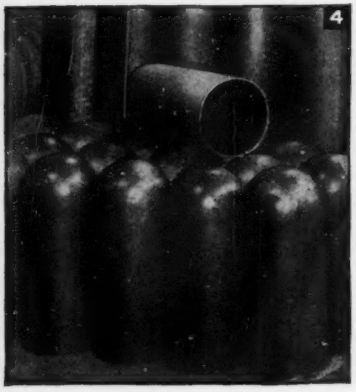
1 Produced from 8 S.W.G. Stainless Steel.

2 Produced from 15/32" Mild Steel. Pressed cold in tools fitted with Harper Meehanite Inserts. 28,000 pressings have been produced without any tool reconditioning.

3 Produced from 18 S.W.G. Stainless Steel. 9,800 pressings made without any tool reconditioning.

4 Produced from 14 S.W.G. Mild Steel. 10,700 pressings produced; tools only reconditioned once.

5 Produced from 10 S.W.G. Mild Steel. 2,350 pressings produced without any tool reconditioning.



Harper quality covers grey iron, ductile iron and Meehanite castings, also metal pressings and other finishes and sub-assembly work.

HARPER CASTINGS

CASTINGS WITH THE HARPER SKIN

JOHN HARPER & CO. LTD. **JOHN HARPER** (MEEHANITE) **LTD.**

ALBION WORKS Phone: WILLENHALL 124 (5 lines) Grams: HARPERS, WILLENHALL **WILLENHALL**

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- *Automatic lubrication*
- *Quick power traverse*
- *2½ in. bar 16 in. swing*

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H·W·WARD & CO LTD
SELLY OAK
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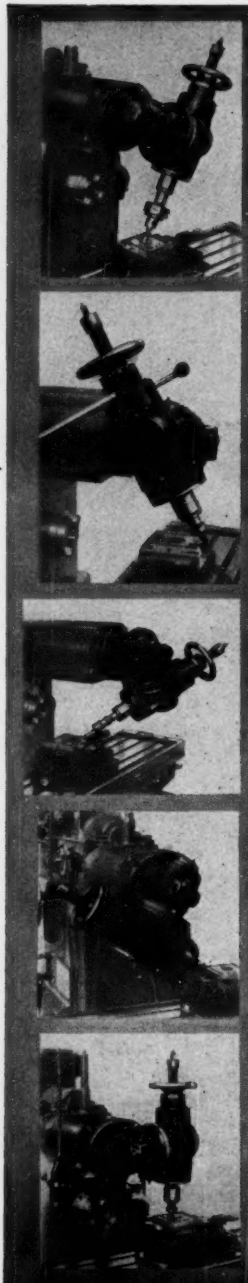
TELEPHONE SELLY OAK 1131

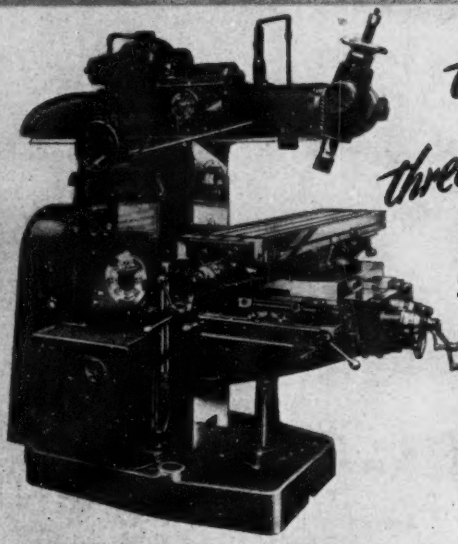
BRITISH MACHINE TOOL MAKERS ASSOC. LTD

W667



NEW UNIVERSAL MILLING HEAD

adds VERSATILITY



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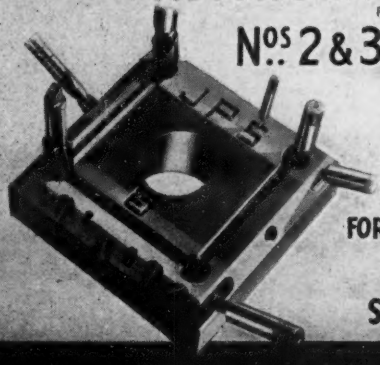
MOTOR DRIVEN HEAD FOR Nos. 2 & 3 MILLERS



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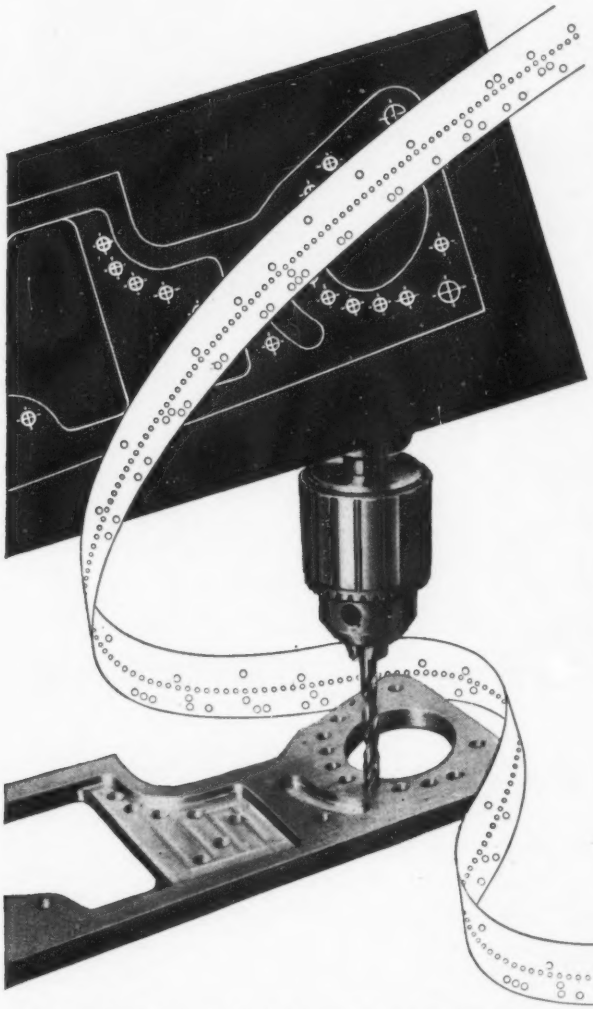
J PARKINSON & SON (SHIPLEY) LTD

SHIPLEY TELEPHONE 53231 YORKSHIRE

P.359c



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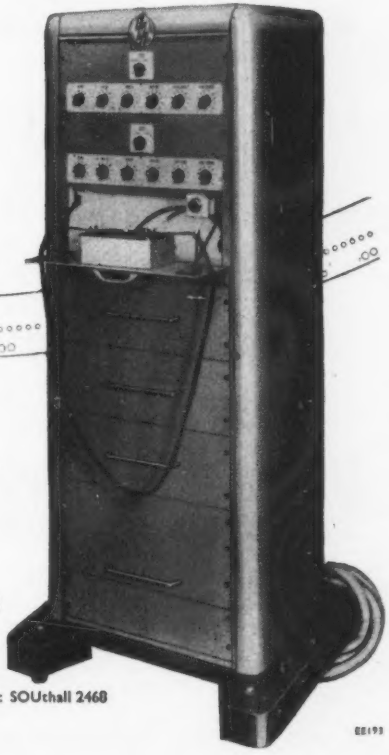
E.M.I. ELECTRONIC POSITIONING CONTROL

for: Borers

Drilling Machines

Rotary and Linear Tables



E.M.I., leaders in the field of electronic systems for industry, offer the most advanced equipment for accurately controlling boring and drilling operations.
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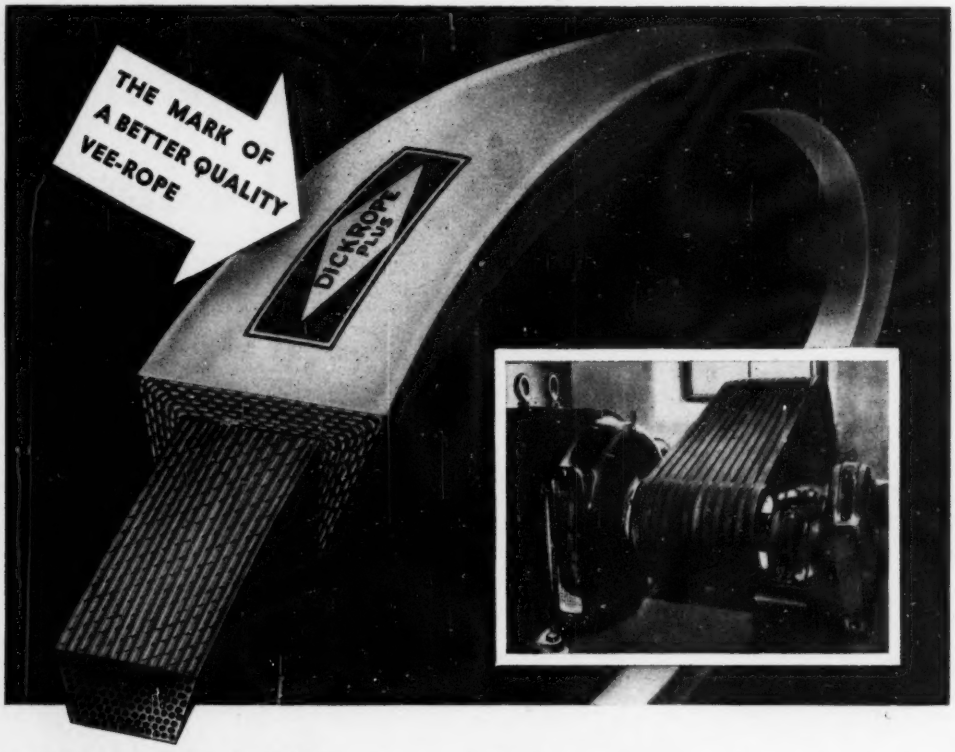

DICKROPE-PLUS for efficiency and economy

HAS HIGH TENSILE STRENGTH FOR MAXIMUM TRANSMISSION

Dickrope-Plus is built rather like a motor tyre. Under the abrasion-resistant outer cover there is an inner core of load-carrying multiple high tensile cords made from specially treated continuous filament yarn. It has just the right amount of 'give' in it, so that, under the repeated strains of high starting torques, pulsating or shock loads and severe flexing experienced on high-speed drives, Dickrope-Plus retains its shape and its strength. Designed for high-speed machinery and short centre drives, Dickrope-Plus transmits more power than cotton corded vee belts. Available in heat, or oil resistant, and anti-static qualities.

OTHER FAMOUS DICK PRODUCTS INCLUDE

DICK'S ORIGINAL BALATA. The best general purpose belt you can buy.

DIXYLON SUPLEX. The most modern development in power transmission. Specially designed for machine tool power drives. An oil resistant plastic transmission belt with anti-static properties.

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DIXEL V-ROPE. Industry's Super Drive. For main engine, generator and countershaft drives. Can be spliced endless with solution and rivets or with our "Quickfix" bolts.

DIXLINK. The link vee-belt that solves problems and presents none. Saves dismantling costs.

RUBERIX. The solid woven rubber belt with the high coefficient of friction.

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Branches at GLASGOW, LONDON, BRISTOL, BIRMINGHAM, MANCHESTER, LEEDS, NEWCASTLE, DUNDEE, BELFAST, DUBLIN, AMSTERDAM and VIENNA. Agencies throughout the world. American factory at Passaic, New Jersey.

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NEW DESIGN!

LARGER CAPACITY!

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FILING & SAWING MACHINE

for the manufacture of Dies, Gauges etc. to very close limits

SPECIAL ATTACHMENT PERMITS FILING & SAWING OF HARDENED STEEL & TUNGSTEN-CARBIDE

SPECIAL THIEL *FEATURES include—*

Infinitely Variable Speed
Infinitely Variable Stroke Adjustment
Stroke adjustment does not necessitate altering table height
Table tilts 15° in both directions
Tungsten-Carbide and Hardened Steel filing and sawing (Special attachment)

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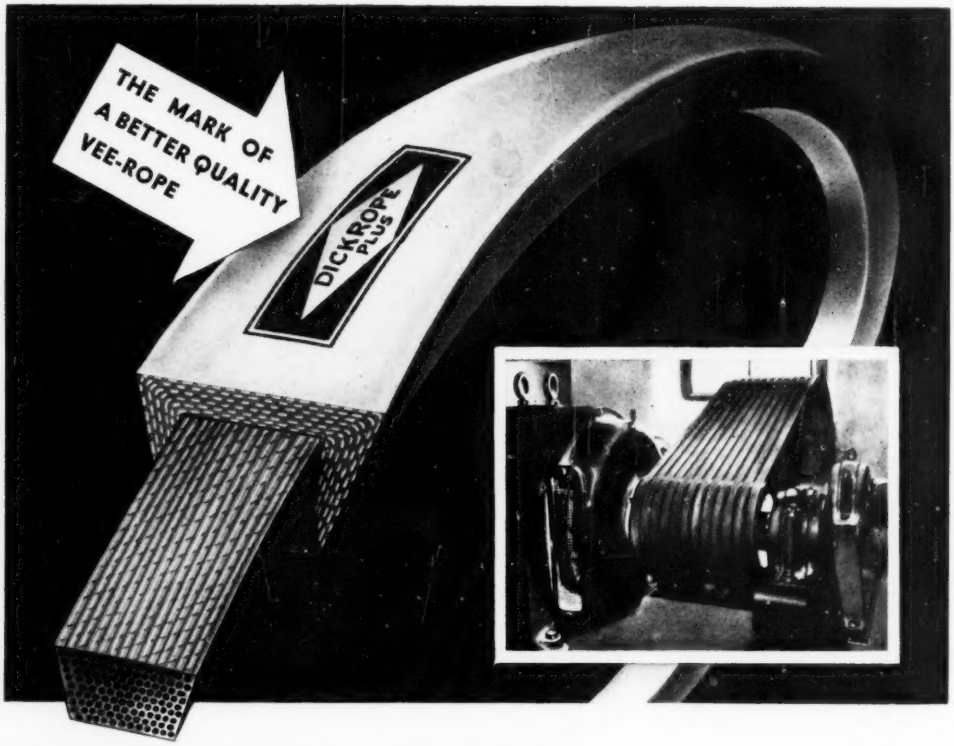
Thiel 115

B*



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Dickrope-Plus is built rather like a motor tyre. Under the abrasion-resistant outer cover there is an inner core of load-carrying multiple high tensile cords made from specially treated continuous filament yarn. It has just the right amount of "give" in it, so that, under the repeated strains of high starting torques, pulsating or shock loads and severe flexing experienced on high-speed drives, Dickrope-Plus retains its shape and its strength.
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DIXIT BELTING. For high-speed drives in hot or humid atmospheres.

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DIXLINK. The link vee-belt that solves problems and presents none. Saves dismantling costs.

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FILING & SAWING MACHINE

for the manufacture of Dies, Gauges etc. to very close limits

MODEL 115

SPECIAL ATTACHMENT PERMITS FILING & SAWING OF HARDENED STEEL & TUNGSTEN-CARBIDE

SPECIAL THIEL *FEATURES include—*

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Stroke adjustment does not necessitate altering table height

Table tilts 15° in both directions

Tungsten-Carbide and Hardened Steel filing and sawing (Special attachment)

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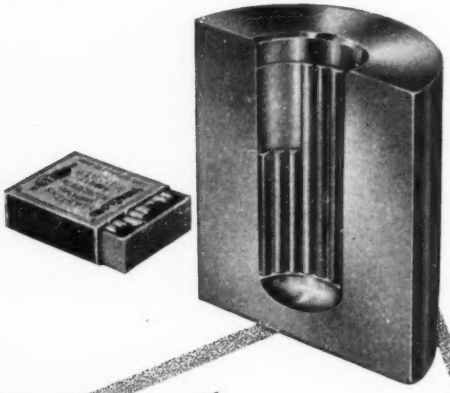
B★

COLD HOBBING PRESSES

BY SACK & KIESSELBACH



SEVERAL SIZES from 100—3,000 TONS CAPACITY

MASSIVE CAST STEEL BODY

PATENT SWIVELLING CLEAR-VIEW GUARD

CAN BE USED with DEPTH or PRESSURE LIMITING DEVICE

BUILT FOR THE JOB

Note depth measuring device, automatically stopping machine when required depth has been reached.

SACK & KIESSELBACH have for many years been building Cold Hobbing Presses. These machines are therefore not adaptations but are designed and built for this work only. Their sound, robust basic design, high quality workmanship plus several special features found only on these machines greatly facilitates the production of sound moulds. Further details on request.

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MACHINE TOOL CO. LTD.

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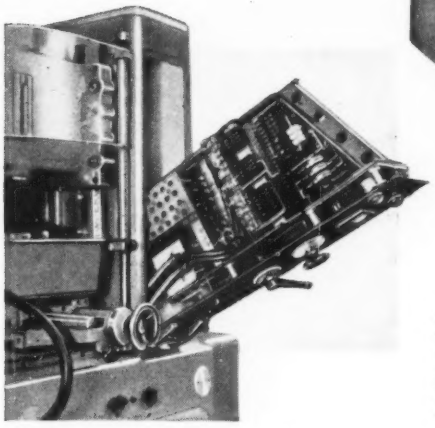
SK1

THE *FIRST* SPARK ERODER BUILT AS A PRECISION MACHINE TOOL

ELERODA D1

Today's answer to the making of Drawing and Piercing Dies and the making and reconditioning of Forging and Stamping Dies—Machines the "Unworkable" metals.



A precision Swiss built machine which is today's answer to the machining by electro erosion of metals of any hardness such as hardened steel, tungsten carbide and nimonic without causing distortion of work or alteration of mechanical or physical properties of machined surfaces. The patented electrical circuit combined with the sensitive electro hydraulic servo-mechanism ensures speed of operation and high precision. Six different surface finishes from coarse for roughing to the finest finish are obtainable. 20 power settings. Automatic depth cutout.

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MACHINE TOOL CO. LTD.

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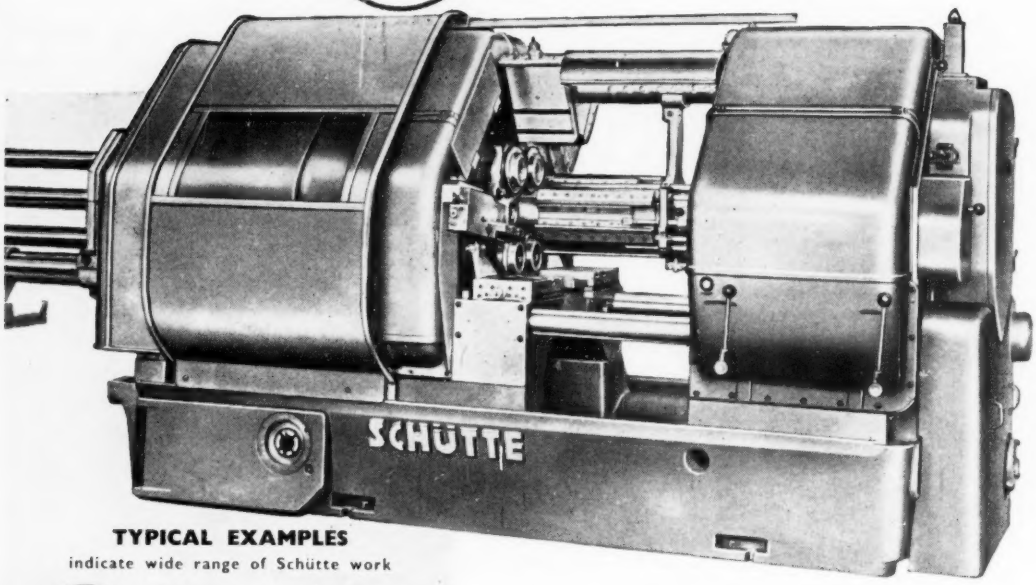
Nothing too difficult for a SCHÜTTE AUTOMATIC!



TYPICAL EXAMPLES
indicate wide range of Schütte work

Note internal hexagon socket, marking stamped on and tapped hole chamfered on the parting-off side.
Note rolled thread, internal hexagon, marking stamped on and clean parting-off.
Note profile, material, eccentric boss, screw-driver slot and clean parting-off.
Note deep hole, eccentric piece and internal hexagon.
Note wide slot, cross hole and spherical end.

Advanced design. Result of 40 years specialist experience in building and tooling of automatics.

Independent longitudinal and cross slides for each spindle. Ensures correct feed for each operation—often eliminates special attachments.

Side-cam-shafts. Unrestricted swarf passage, easy accessibility.

Automatic safety attachments. Automatic spindle stop when end of bar is reached.

6 spindle bar Automatics for $\frac{5}{8}$" to $3\frac{1}{4}$" bar capacity.

6 spindle chucking Automatics for $6\frac{1}{4}$" and 8" chucking capacity.

Tooling layouts and production times will be gladly provided on request.

Please ask for leaflet R.451 which will show you further examples.

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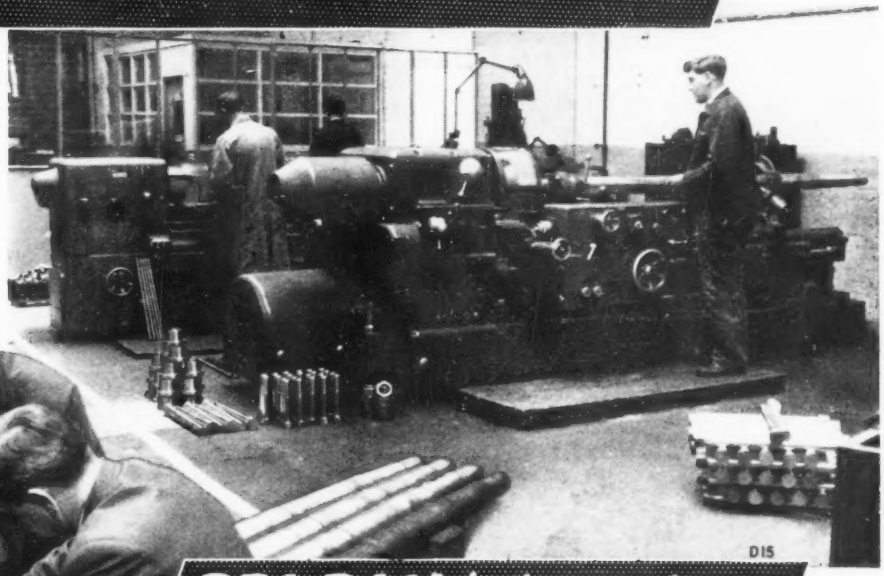
SCH6

thread chasing on a semi-automatic



CRI-DAN high-speed threading machines

Cri-Dan Threading Machines installed by The National Gas & Oil Engine Company Ltd. for cutting threads from ½" external up to 8" internal in materials ranging from cast bronze to high-tensile alloy steel. They have achieved remarkable savings in production costs.

Precision threads cut in a fraction of the time taken on a thread miller or centre lathe. Capable of cutting external or internal, parallel or taper, right or left-hand, single or multi-start threads in all forms and in any material that can be threaded.
Attachments for boring, turning, facing and chamfering in the same set-up as threading, can be fitted.

Two sizes for cutting threads up to 4" (ext.) 6" (int.) and 12" (ext.) 16" (int.). Max pitch cut 5 and 2 t.p.i. respectively.

ALFRED HERBERT LTD. COVENTRY
Factored Division, Red Lane Works

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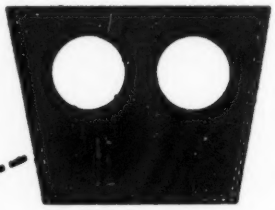
the GROMMET story



4 good reasons for fitting BTR High Test **V-BELTS**

1 HIGHER HORSEPOWER

Grommet construction makes the most efficient use of high tensile cords to produce the strongest V-belts yet made. For grommet construction ensures that *all* the cords of a belt share the load *equally*—which is the condition for maximum transmitting efficiency. Furthermore, a grommet, being an endless loop of high tensile cords, has no joints to weaken the belt, no overlapping sections to stiffen it.

2 MORE GRIPPING POWER

Grommet construction ensures that the belt exerts full driving grip on the walls of the pulley groove, for there are no central cords to dip and 'dish' the belt, pulling it away from the walls under load. This extra driving grip allows heavier loads and prevents belt slip.

3 MORE OUTPUT FOR ELECTRICITY CONSUMED

Despite its superior strength, a grommet is the most flexible V-belt load carrying device yet developed. Thus the belt runs cool and absorbs minimum energy in flexing around the pulleys. This saving in power appears in extra pay-load for electricity consumed.

4 LONGER BELT LIFE

Operating with a higher safety factor than ordinary V-belts, BTR grommet V-belts last longer because they are stronger and also because being so flexible they are subject to little strain in flexing round the pulleys.

BTR ENGINEERS IN RUBBER

BTR HIGH TEST GROMMET V-BELTS

Patented in Great Britain by BTR Patent No. 567406

BTR Industries Ltd HERGA HOUSE, VINCENT SQUARE, LONDON S.W.1 *TEL: VIC 3848*

D1359

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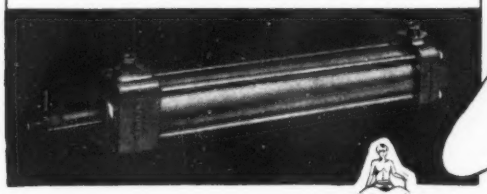
a power for production that's yours to command

What you need in your works is this pocket-sized elephant — PNEUTOMATION! You'll find PNEUTOMATION has all the power of a pachyderm, plus compactness. You get the same tireless energy, accurately applied to the right place at the right time, under perfect control. PNEUTOMATION is tailor-made to work with the minimum of elbow room and the wide range of standard equipment fits any job from bell-ringing to jig-boring. Simple design, careful workmanship and completely non-corrodible materials cut replacement and maintenance costs, make Lang PNEUTOMATION a really long-lasting, trouble-free system.

Pneutomation never forgets to operate

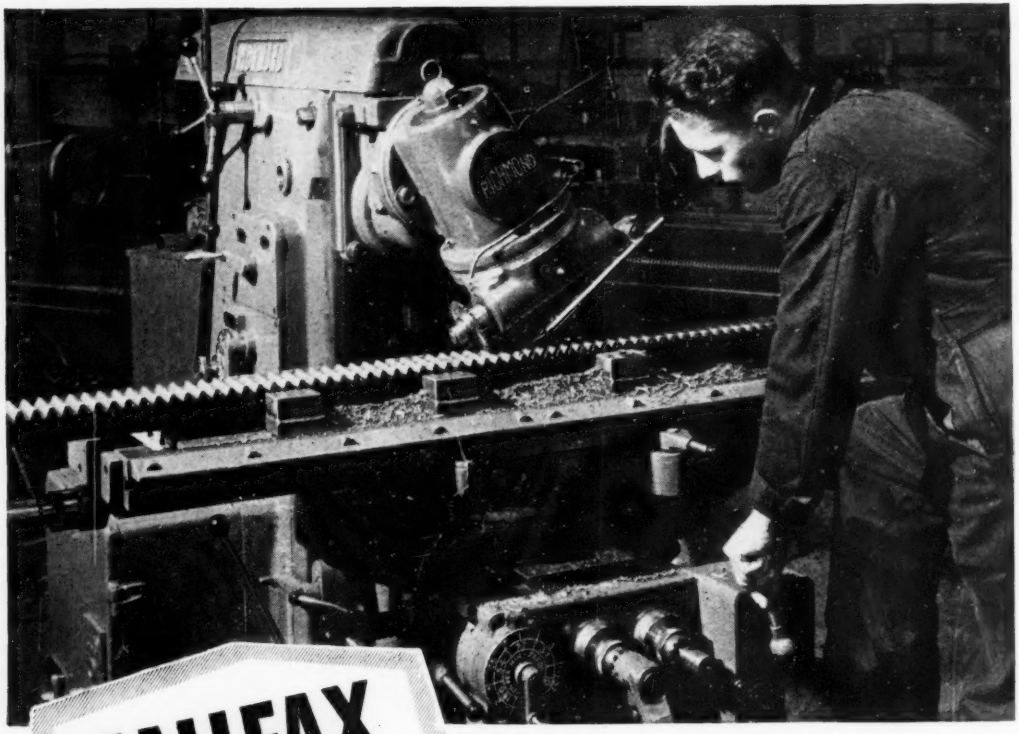
The 'Pneulang' basic cylinder unit, just one of the 264 cylinders available 'off-the-shelf'. The range of PNEUTOMATION equipment also includes many types of manual and automatic valves, lubricators, air flow regulators, pipes and fittings, etc.



PNEUTOMATION
energy under control

Associated with Desoutter Brothers (Holdings) Ltd.

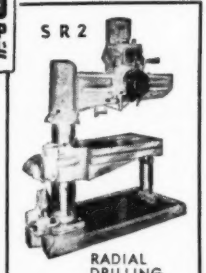
P.1651



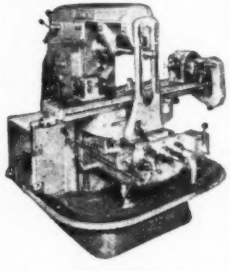
HALIFAX TOOL CO. LTD. *use* RICHMOND MACHINES

The photograph shows a Richmond No. 4 Universal Milling Machine fitted with Universal Milling head in use at the Halifax Tool Co. Ltd. This machine is all-geared for high-speed work to critical limits.

THE 600 GROUP OF COMPANIES



RADIAL DRILLING MACHINE



No. 4 UNIVERSAL MILLING MACHINE

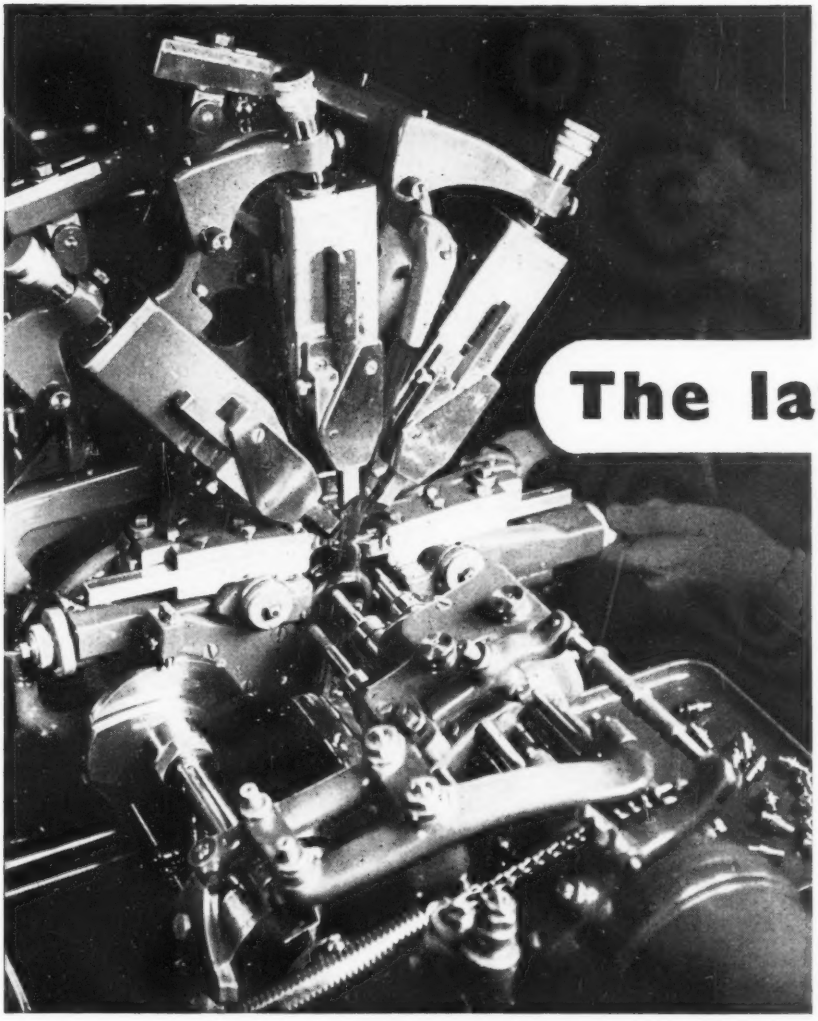
SEND FOR LEAFLETS giving specifications and full technical information of

RICHMOND

MILLING & DRILLING MACHINES

MIDGLEY & SUTCLIFFE LTD.

Hillidge Works : Leeds 10 Tel. Leeds 76032/3



The latest

TORNOS

SLIDING HEAD AUTOMATIC

MODEL R.16

● This model R 16, built by the world's largest and oldest producers of Swiss-type automatics, is the last word in performance, precision and production capacity.

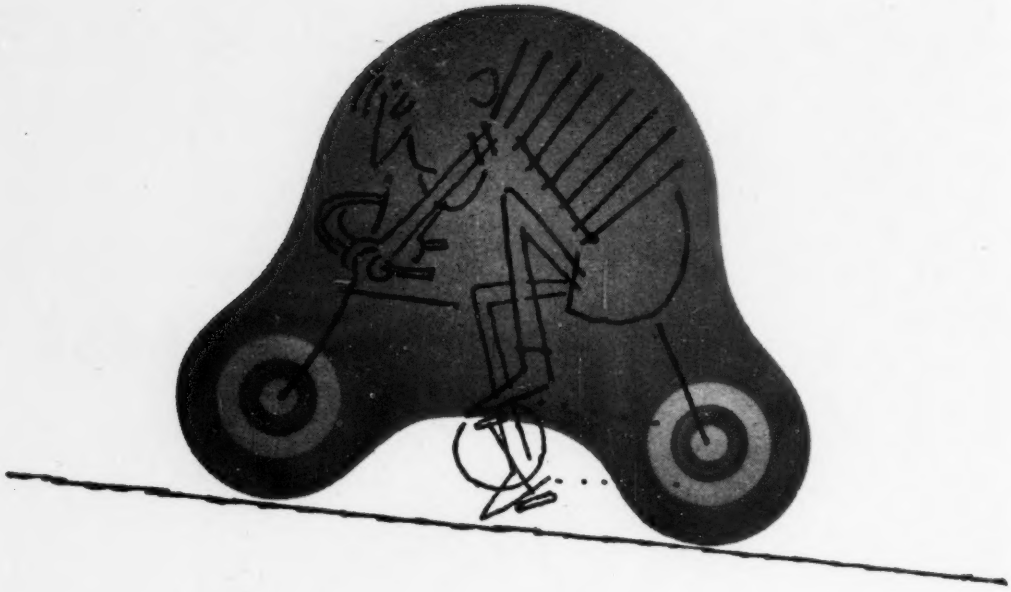
Stock capacity ⅜in. dia., with a maximum turning length of 3½in. or 6in., according to type of cam. 28 spindle speeds 485 to 5,450 r.p.m.

TORNOS Automatics are available in the following sizes:-

Model	M4	M7	R10	R16	M25/28
Max Dia. Bar	5/32	9/32	15/32	5/8	1 3/32

Telephone Coventry 40606 for full details

TORNOS SALES COMPANY, (E. M. Vaughan Ltd.) BROADGATE HOUSE, COVENTRY



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All orders are ready for despatch within 24 hours and delivered immediately in the greater London area by our own transport. Deliveries to other areas — up to 4 days.

Better die sets—and at better prices.

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Head Office: 121 Hay Lane, Kingsbury, London, N.W.9. *Telephone:* Colindale 6346. *Telegrams:* Despnuco, Hyde, London.

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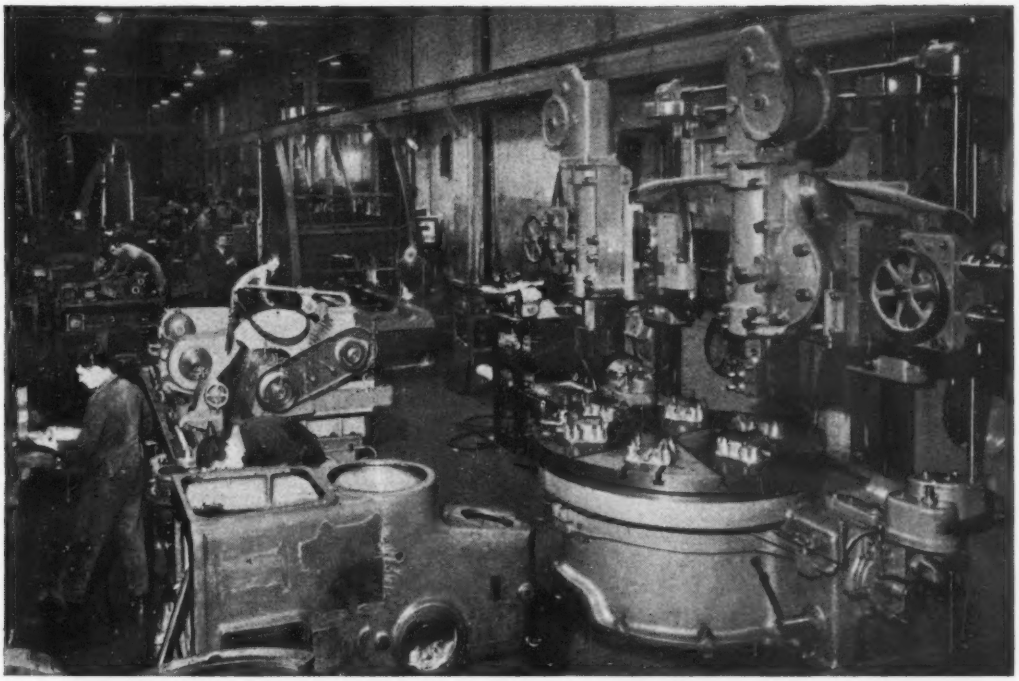

YOUR OWN HEAVY MACHINE TOOLS "SOAG-REBUILT"

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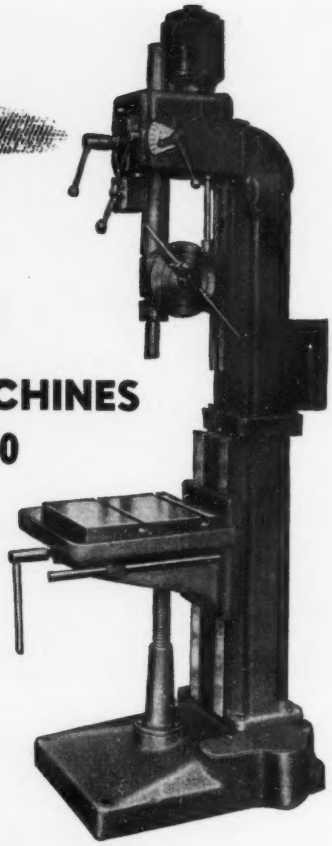

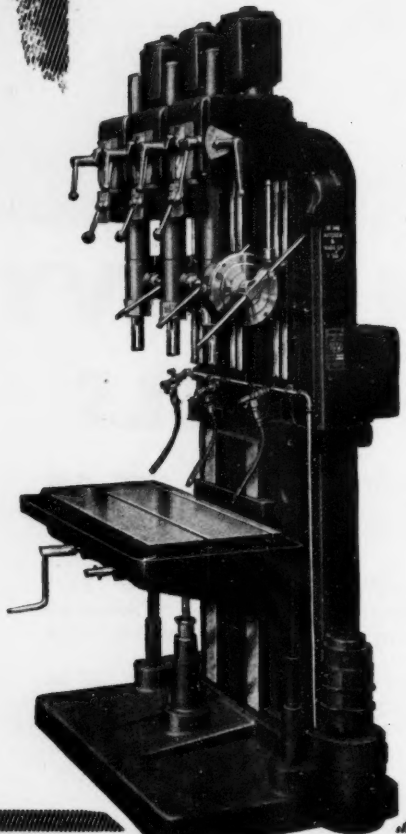

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BORING & FACING TURBINE GEAR CASES AT G. & J. WEIR LTD.

One of several machines in operation in this factory, the No. 3 RICHARDS is shown rough and finish boring and facing the bearing housings in turbine gear cases. With their capacity for high precision, combined with ample speed and power these machines easily maintain limits of 0.0008" on the work in progress.
Revolving table is 48" square, with sliding table 66" by 42". Spindle to table adjustable between 4½" and 56½". Wide range of speeds and feeds covering all materials.
Ask us to send you complete details.

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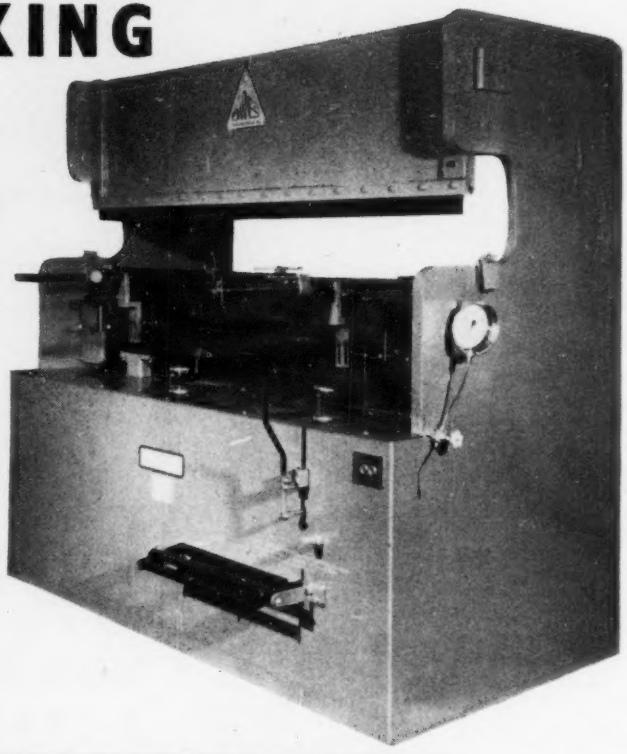

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★ OPEN THROAT DESIGN.

★ STANDARD EQUIPMENT — includes 7 groove die, 90° punch, adjustable gauges.

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6' 0" x $\frac{1}{8}$"	56	0 — 8"
6' 0" x $\frac{1}{4}$"	70	0 — 12"
6' 0" x $\frac{3}{8}$"	105	0 — 12"
6' 0" x $\frac{1}{2}$"	140	0 — 12"
8' 0" x $\frac{5}{16}$"	70	0 — 12"
8' 0" x $\frac{1}{4}$"	105	0 — 12"
8' 0" x $\frac{3}{8}$"	140	0 — 12"
8' 0" x $\frac{1}{2}$"	175	0 — 12"

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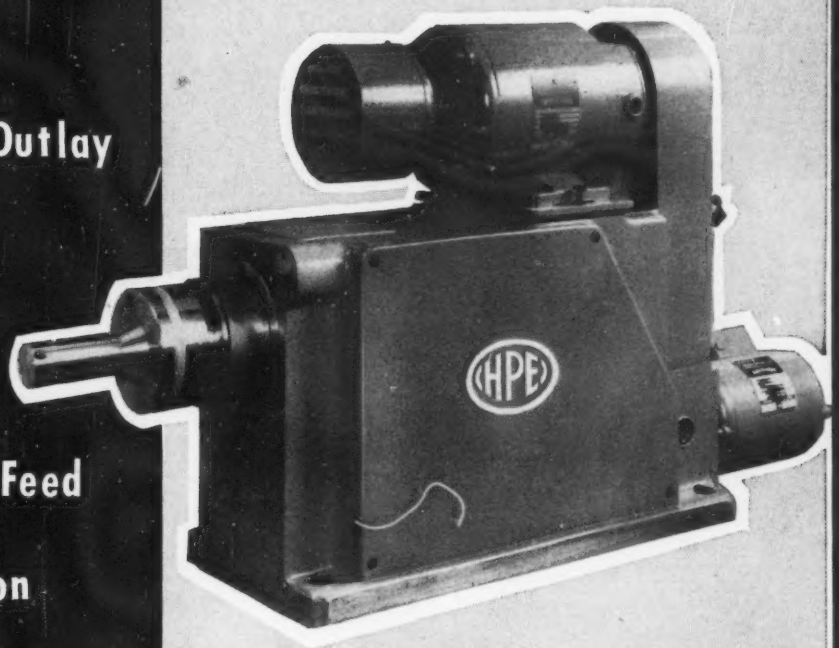

The FB4F Fine Boring Unit Head illustrated above incorporates an independent feed motion, transmitted to its spindle quill through a simple plate cam, which can be designed to give a fast approach and varying rates of feed. The robust spindle and quill, together with super precision spindle bearings, ensure a high degree of finish and roundness.

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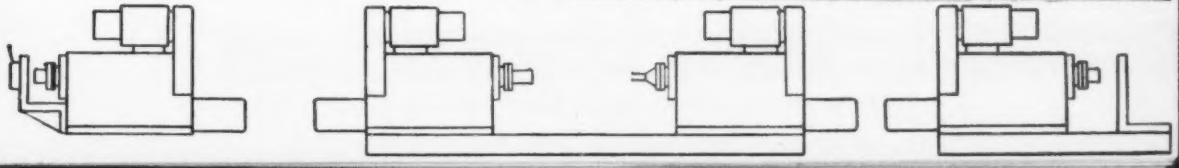

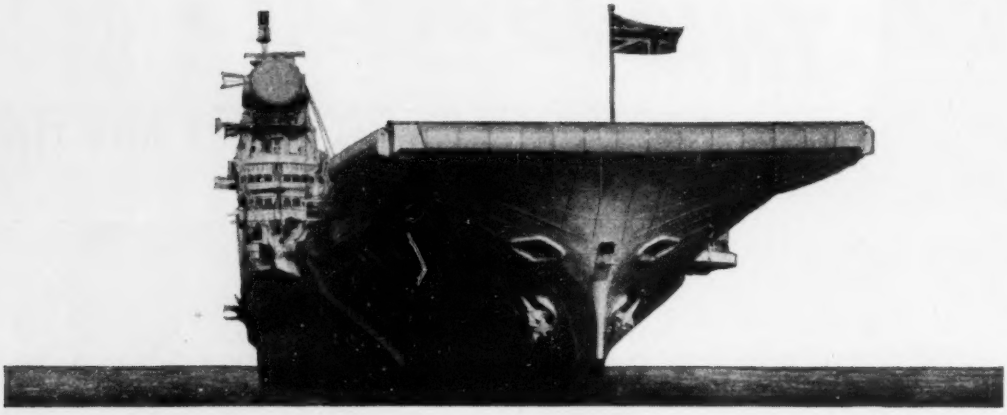

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Production Milling Machine
with automatic cycle

Model 2B also available with normal automatic feed

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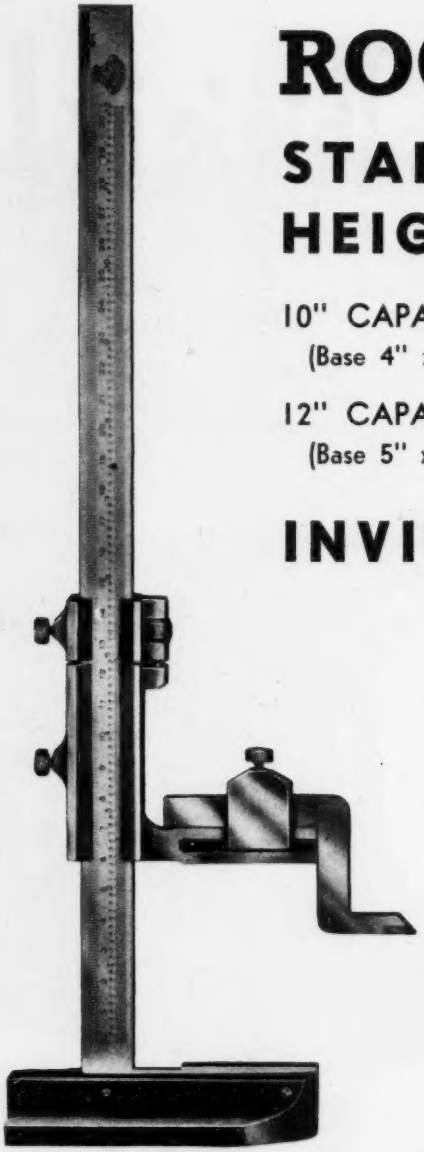

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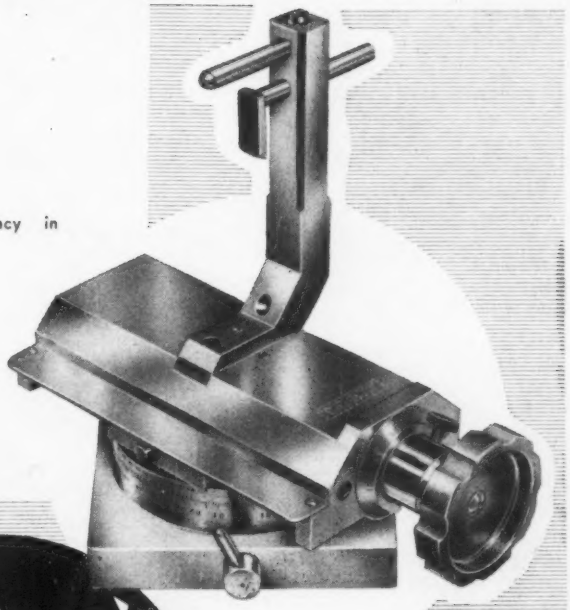

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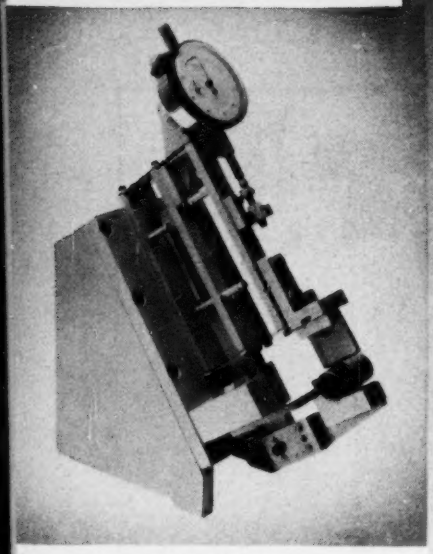
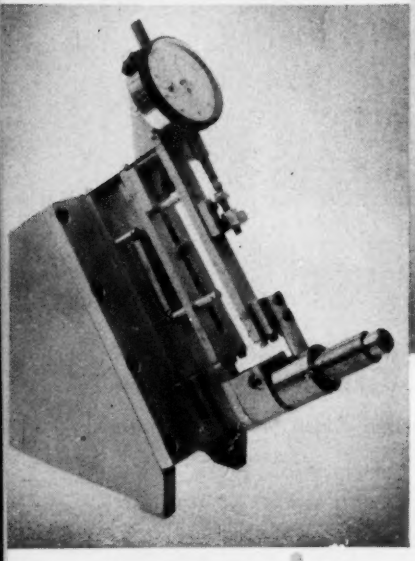


Basic unit arranged to measure outside diameters (above)

Basic unit arranged to measure bore diameter (below)



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Can be used with dial gauges, air gauges or electric measuring heads.

Models can be supplied with self-contained electric sensing device having scale and pointer or signal light indication

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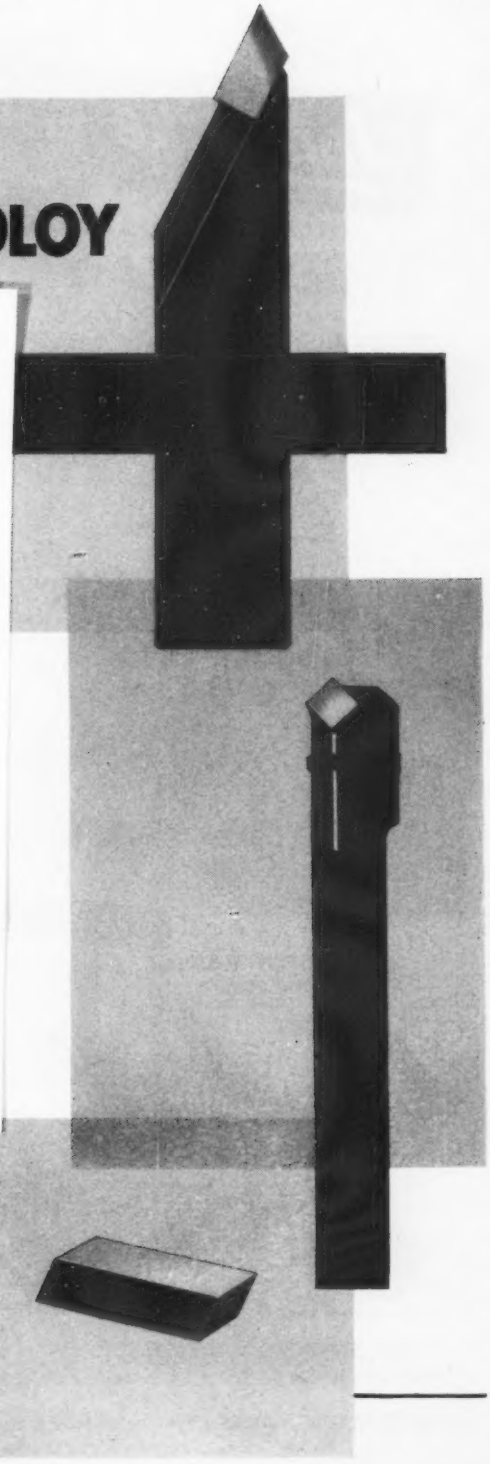

Fischer, Churchill-Redman and H.E.B. lathe tools, Carbitracer and Polytip inserts are all

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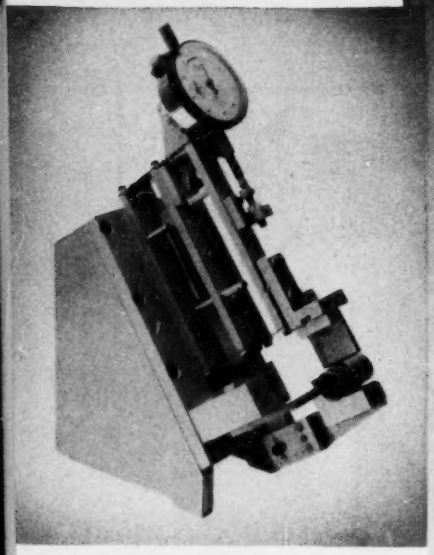
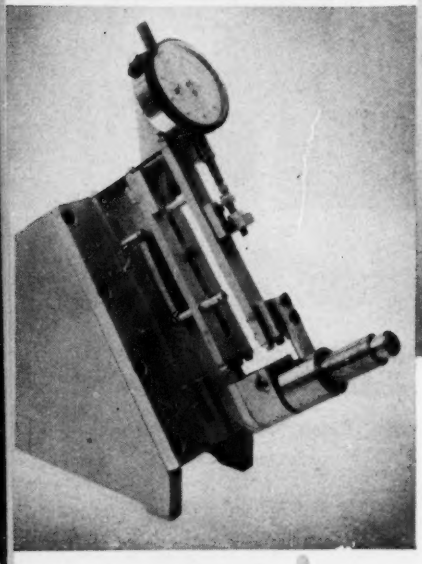
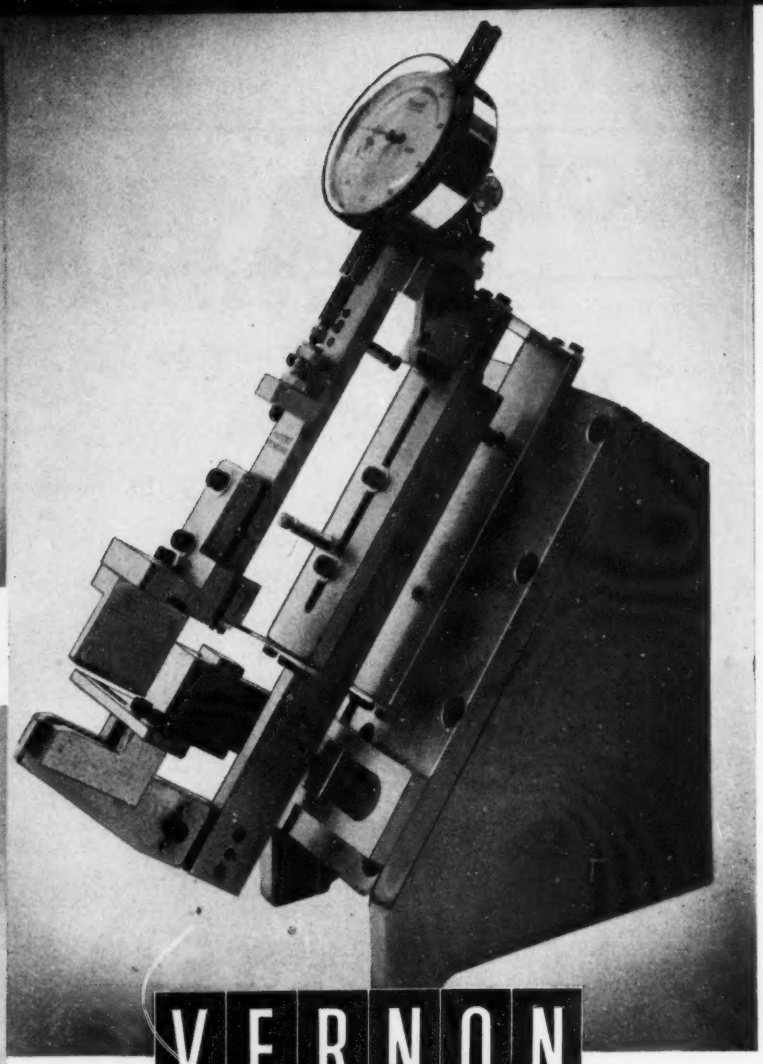


Basic unit arranged to measure outside diameters (above)

Basic unit arranged to measure bore diameter (below)





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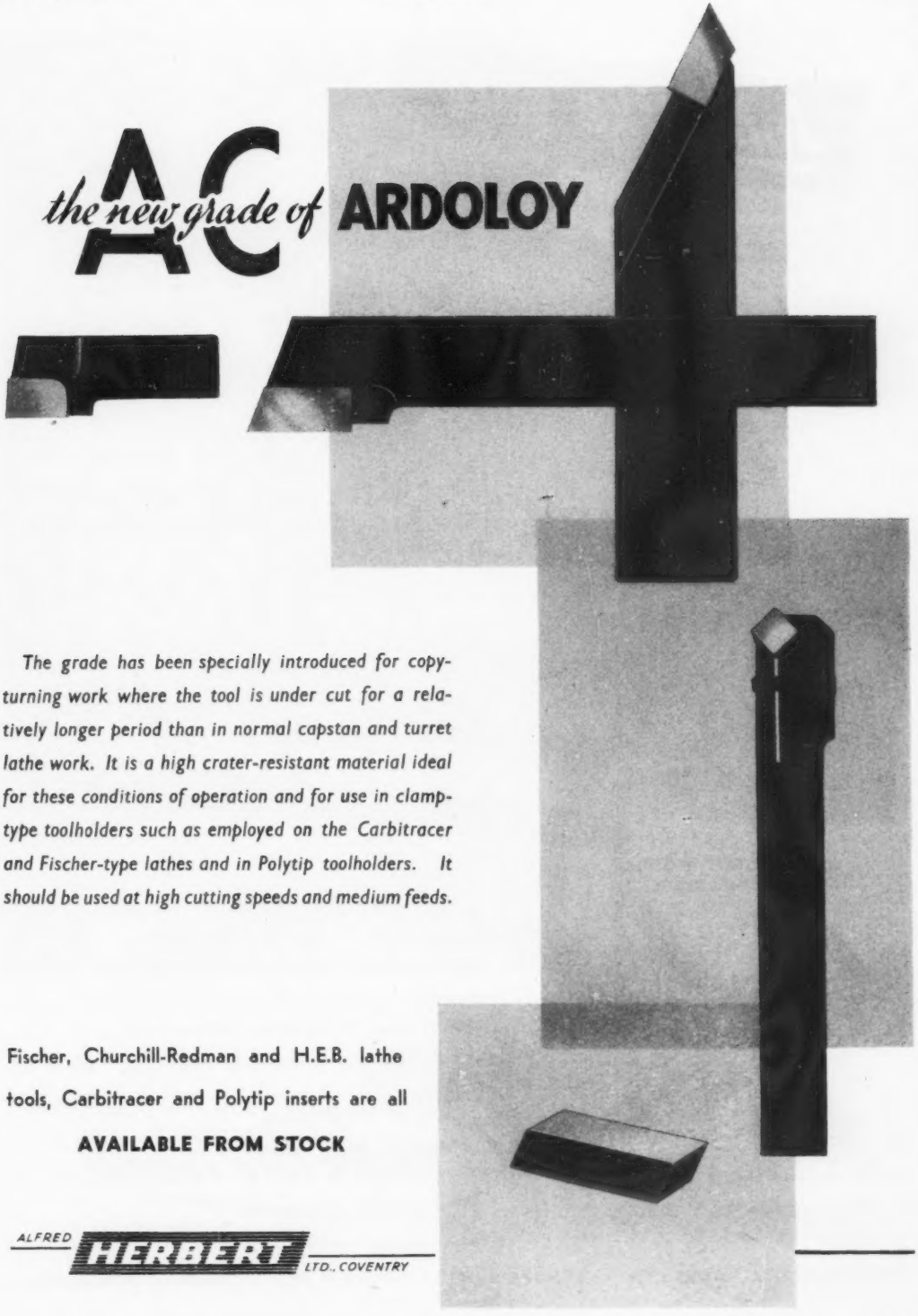

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Drilling capacity in steel	Low speed	½"
... ...	High speed	¼"
Drilling capacity in hard wood ...	Low speed	1"
...	High speed	½"
Watts input on full load		400

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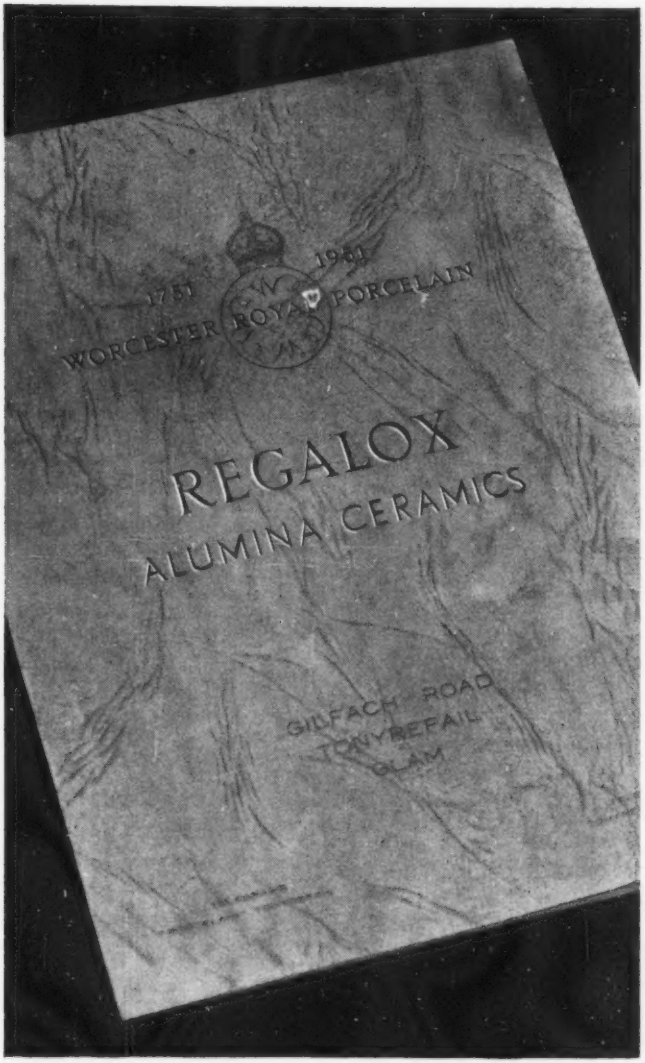

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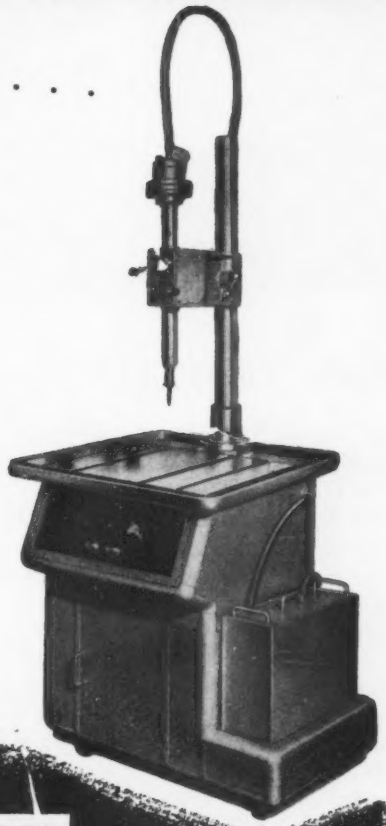

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- **CUTS HOLES OF ANY SHAPE IN HARDENED MATERIAL, CARBIDES ETC.**

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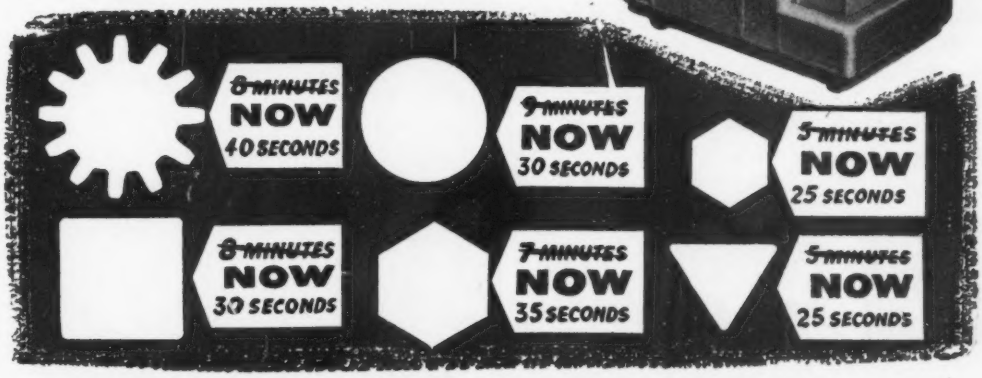
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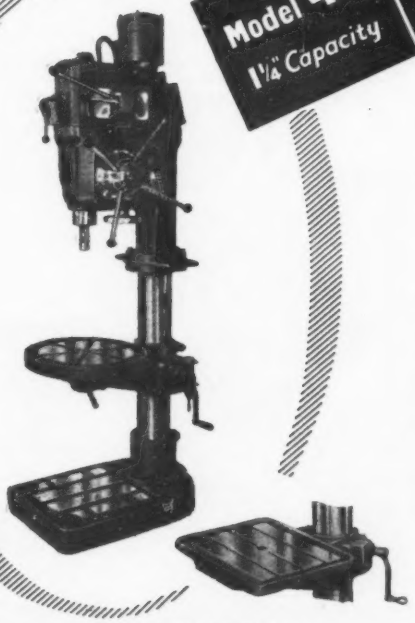

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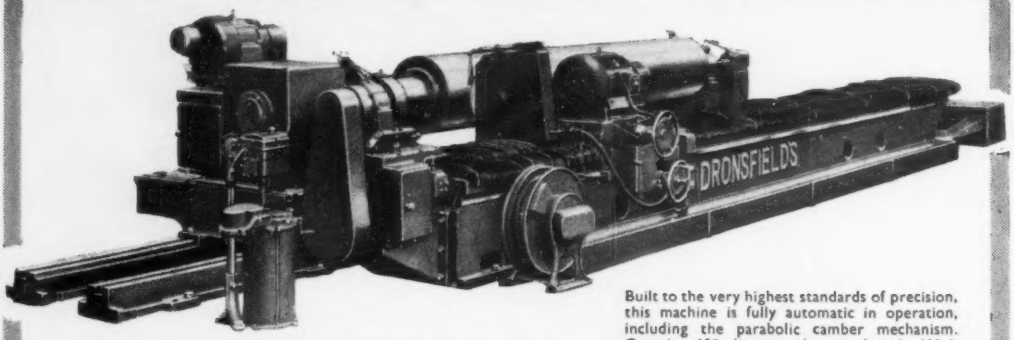
The name for Roll Grinding and Turning Machines



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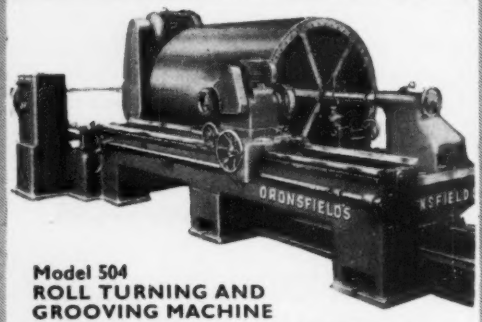

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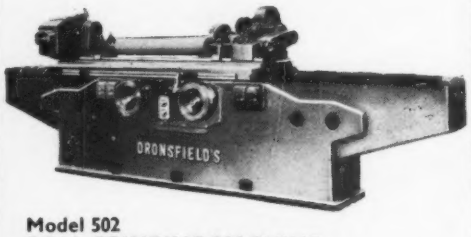

Model 502
ROLL GRINDING MACHINE

Several sizes for work up to 11" diameter by 120" long. Precision built throughout with infinitely variable traverse speeds, from 0 to 100" per min. through dependable hydraulic system.

DRONSFIELD BROTHERS LIMITED

ATLAS WORKS · OLDHAM · ENGLAND · 'Phone: MAin (Oldham) 3857 (3 lines) 'Grams: "ATLAS, OLDHAM"

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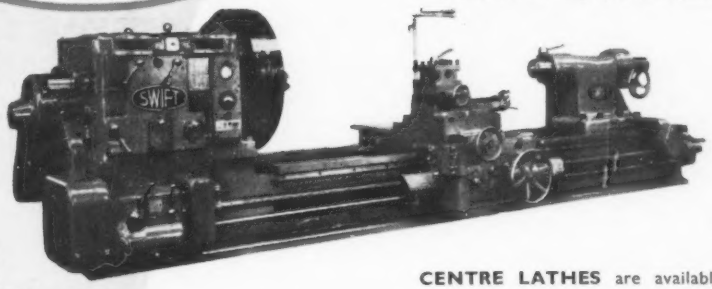
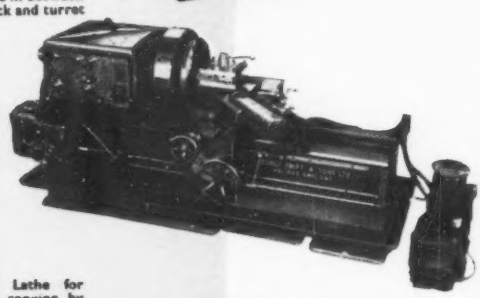
LATHES

are made in a wide range of standard types and sizes, and George Swift & Sons Ltd. have co-operated very closely with customers in supplying lathes to meet many special requirements.



42in. swing Extra Heavy Duty Centre Lathe with 16ft. between centres.



12SV6 Lathe, 28in. swing, with 2ft. 6 in between chuck and turret

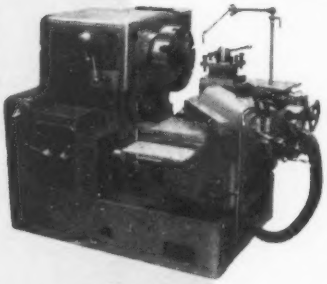
CENTRE LATHES are available with swing over bed 18½in. up to 72in. and any length of bed.

SURFACING & BORING LATHES cover a wide range of applications up to a maximum swing in gap of 99in. Larger sizes can be quoted for.

'T' LATHES for face copying by hydraulic control are built in three sizes to admit 24in., 36in. or 48in. maximum diameter.

ROLL TURNING LATHES are made in standard sizes to admit rolls of maximum diameter 25in. by 8ft., 33in. by 12ft. or 42in. by 18ft.

Write today for a catalogue describing the Swift range of lathes of the type which interests you.



'T' Lathe for face copying by hydraulic control. Maximum diameter admitted on this type 48in.

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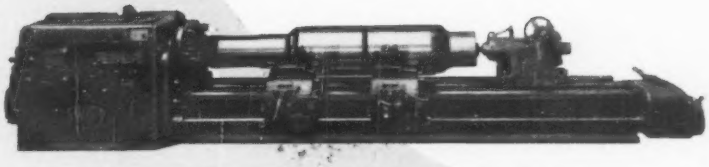
HALIFAX · ENGLAND



RL1 25in. by 8ft. Roll Turning Lathe.

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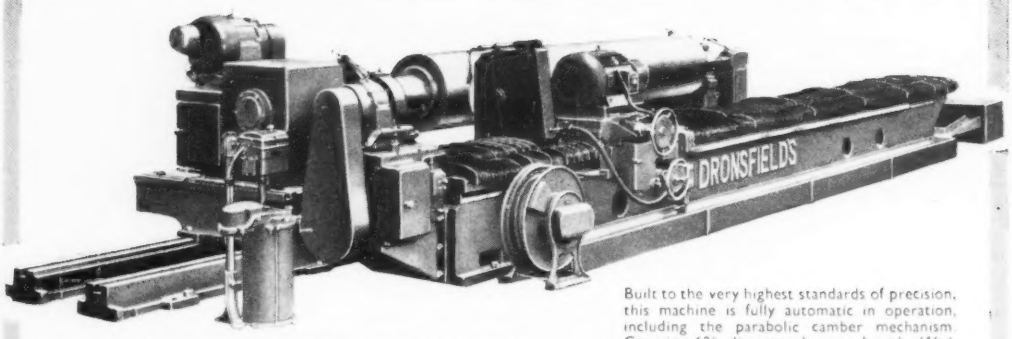
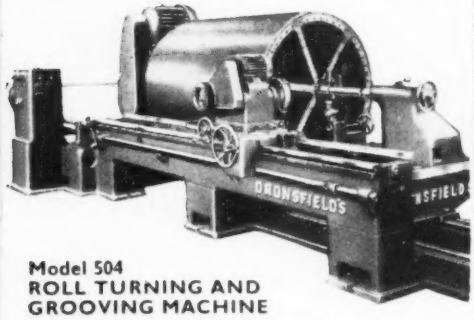
DRONSFIELD'S

The name for Roll Grinding and Turning Machines



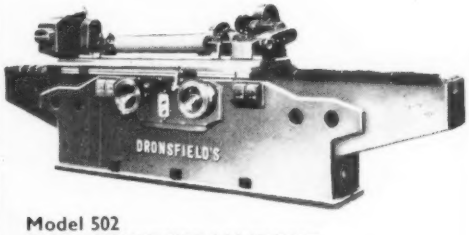
Model 501 ROLL GRINDING MACHINE

Built to the very highest standards of precision, this machine is fully automatic in operation, including the parabolic camber mechanism. Capacity 60" diameter by any length. With speeds from 6 to 54 r.p.m. Wheel traverse 1 to 60" per min. Ask for brochure.



Model 504
ROLL TURNING AND GROOVING MACHINE

Made in three sizes for rolls up to 66" diameter by 120" long. For turning, parting-off, ending out, facing and grooving. Versatile and powerful.



Model 502
ROLL GRINDING MACHINE

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DRONSFIELD BROTHERS LIMITED

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SWIFT

LATHES

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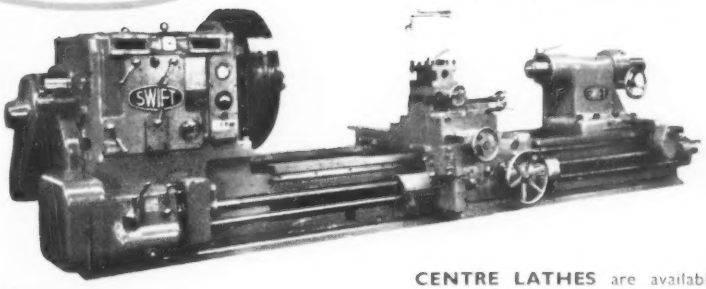
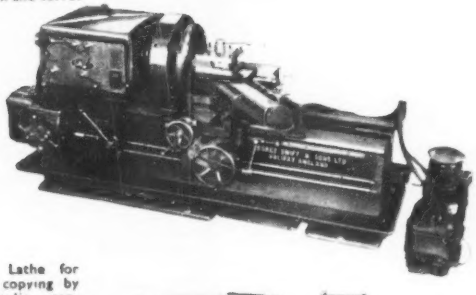


42in. swing Extra Heavy Duty Centre Lathe with 16ft. between centres.



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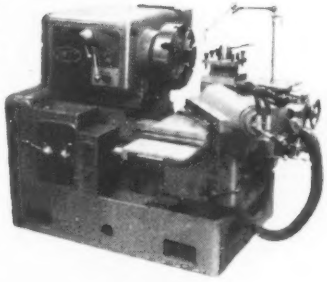

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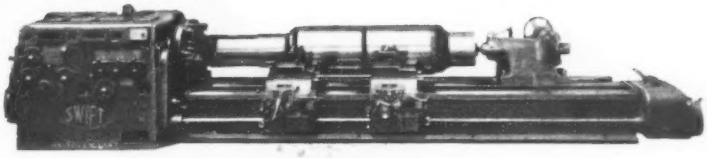

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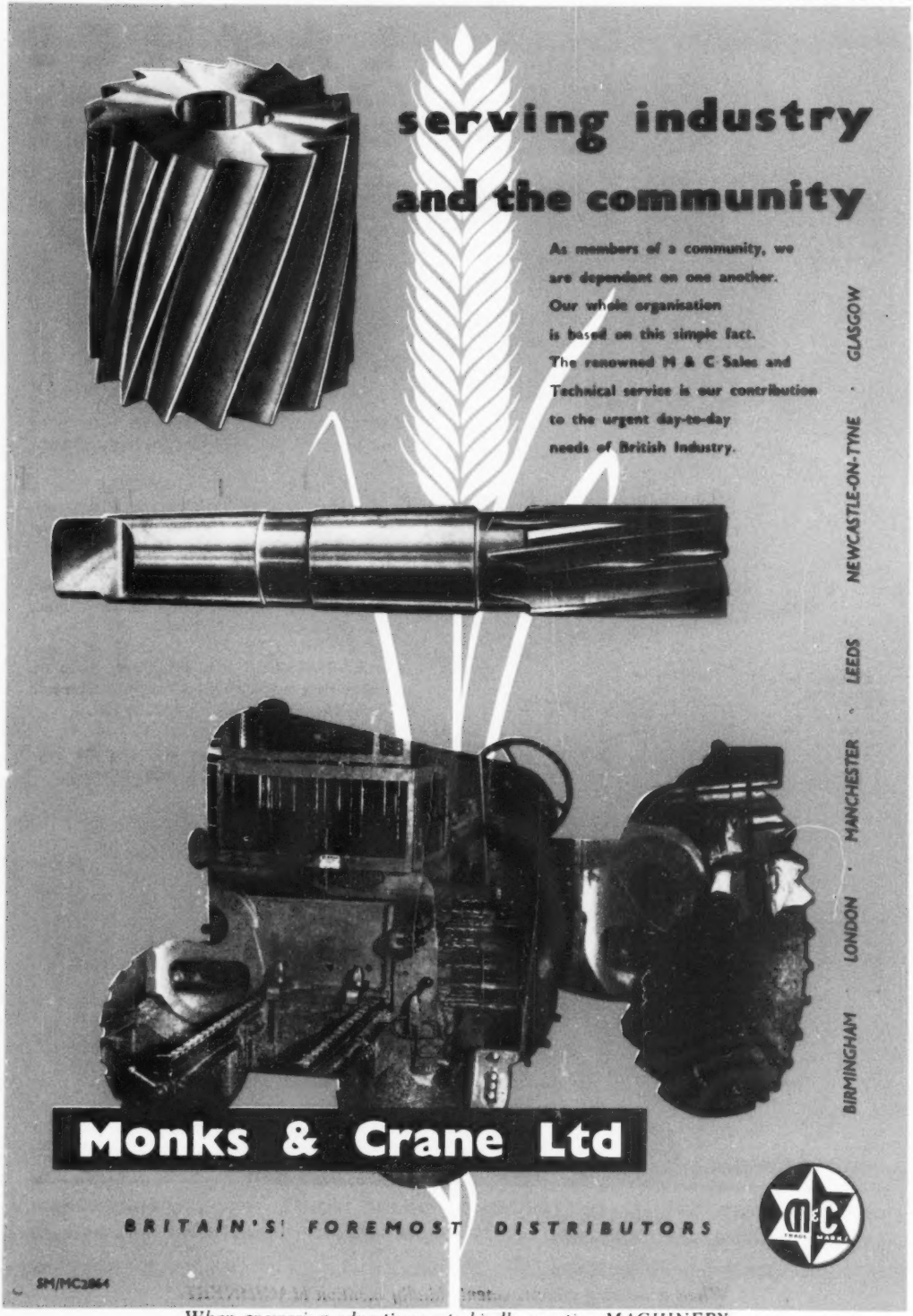
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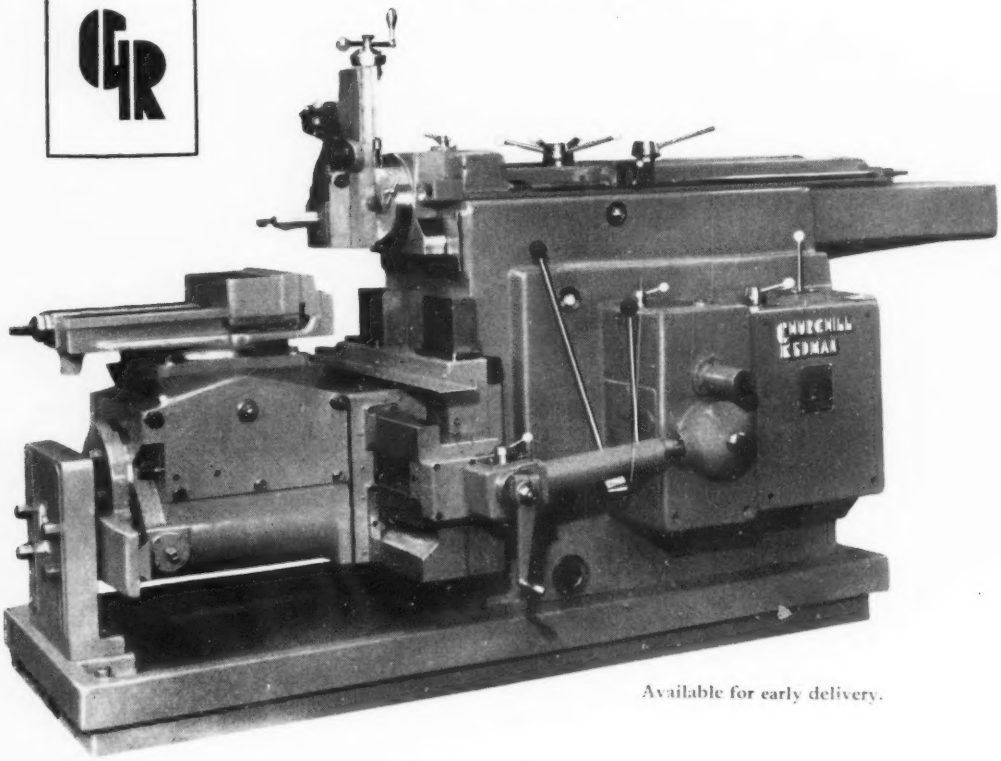

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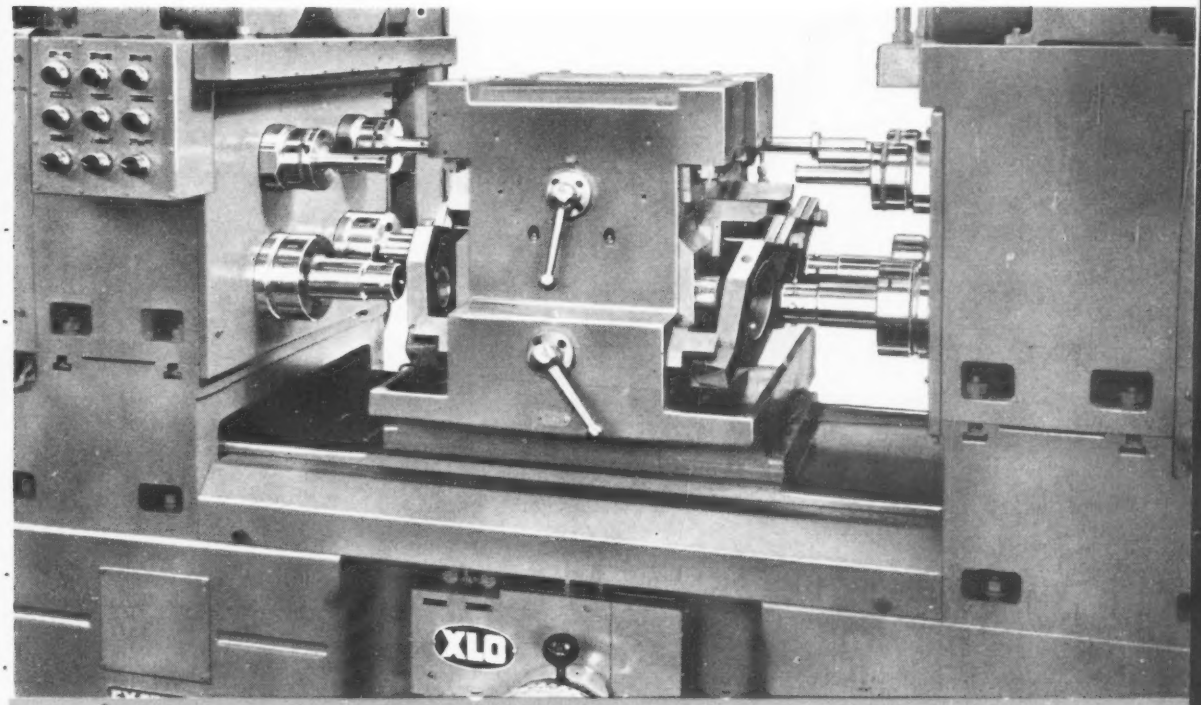

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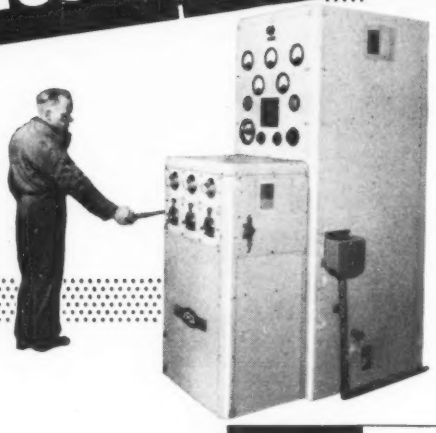

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SPECIFICATION

Swing over bed	11"
Swing in gap	18¼"
Between centres 24" or 40"	
8 or 16 spindle speeds	

11" SWING

£370.0.0

With inbuilt hydraulic copying equipment
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Harrison

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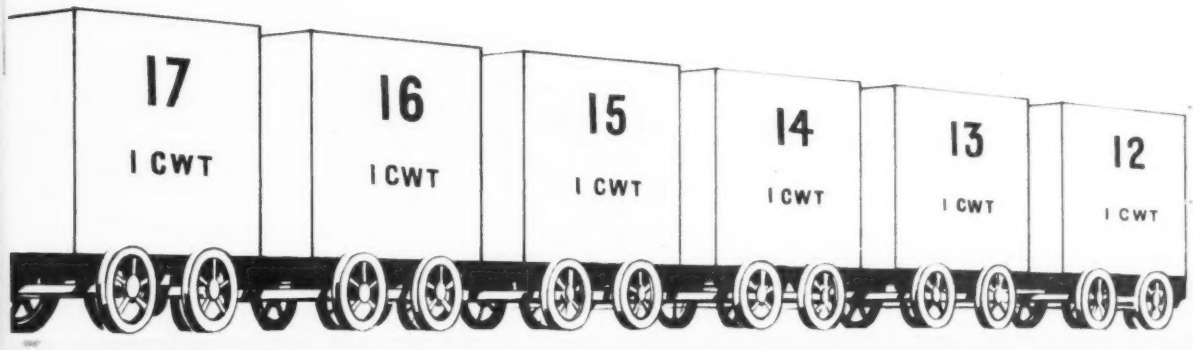
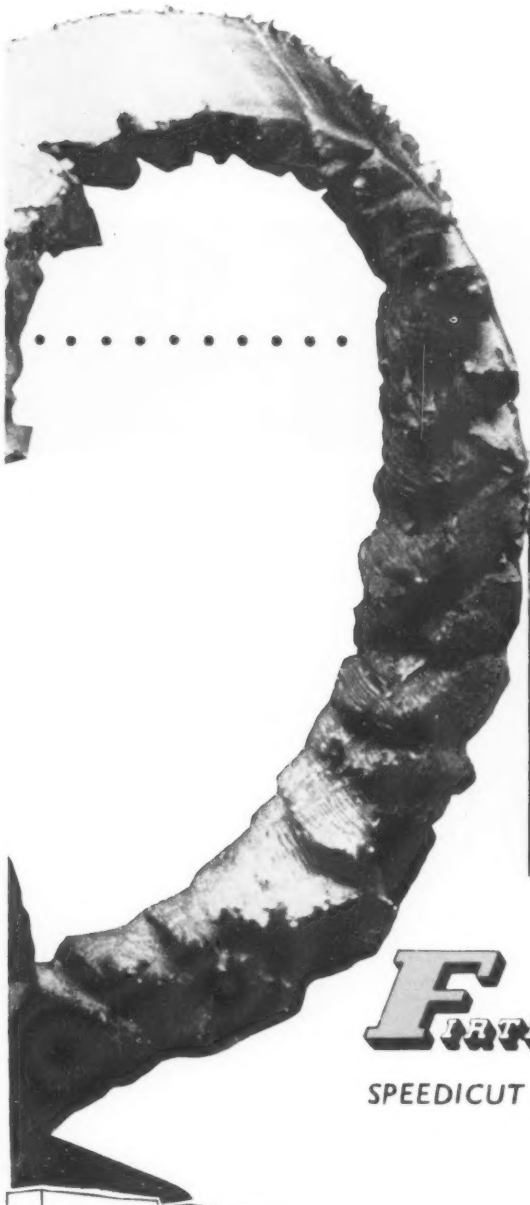


17 CWT. OF METAL



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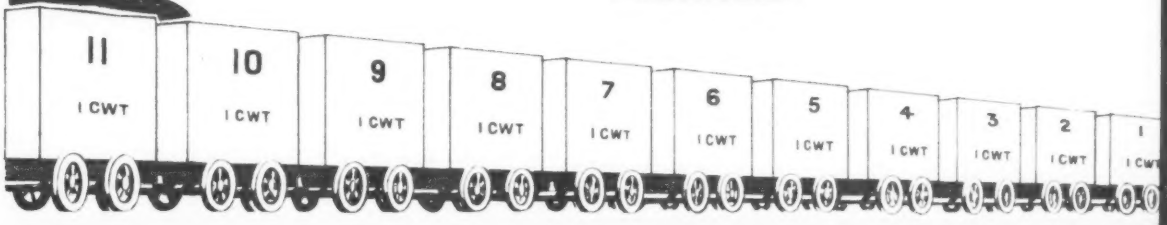

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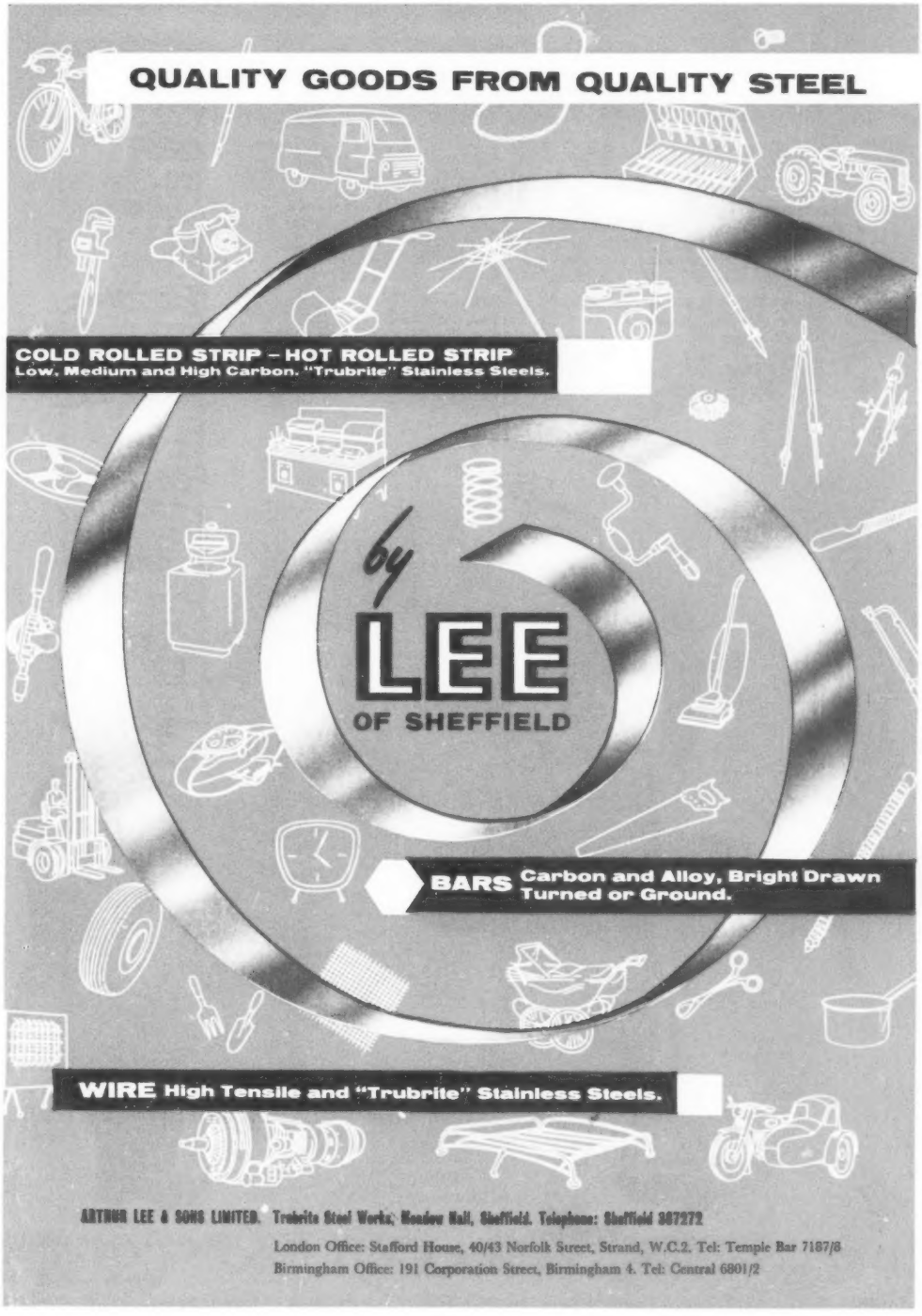
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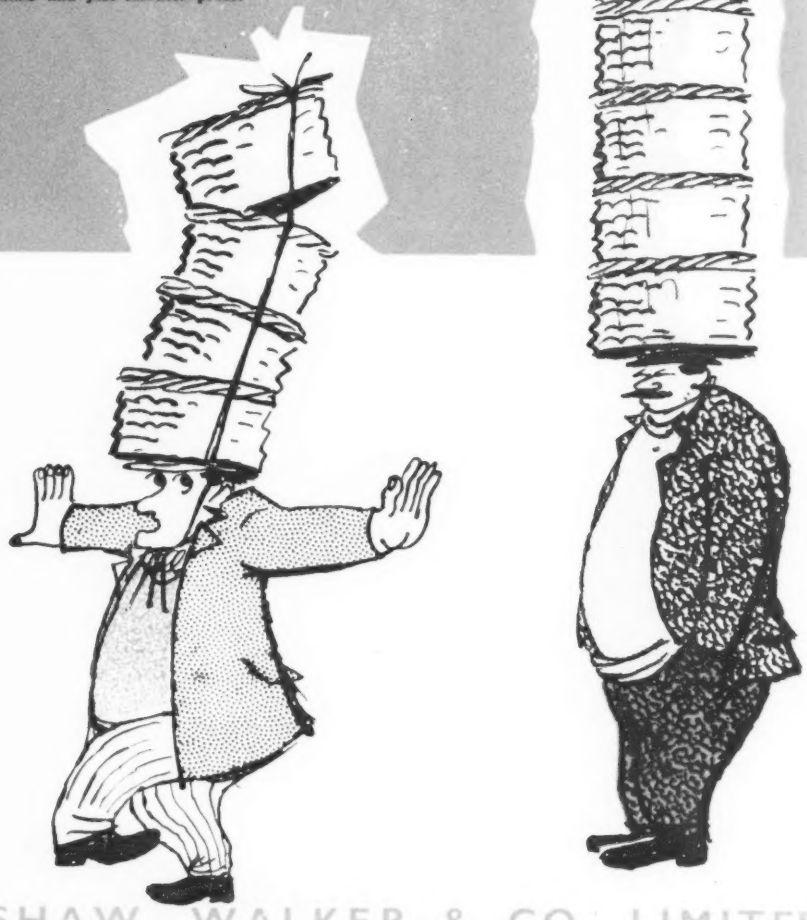

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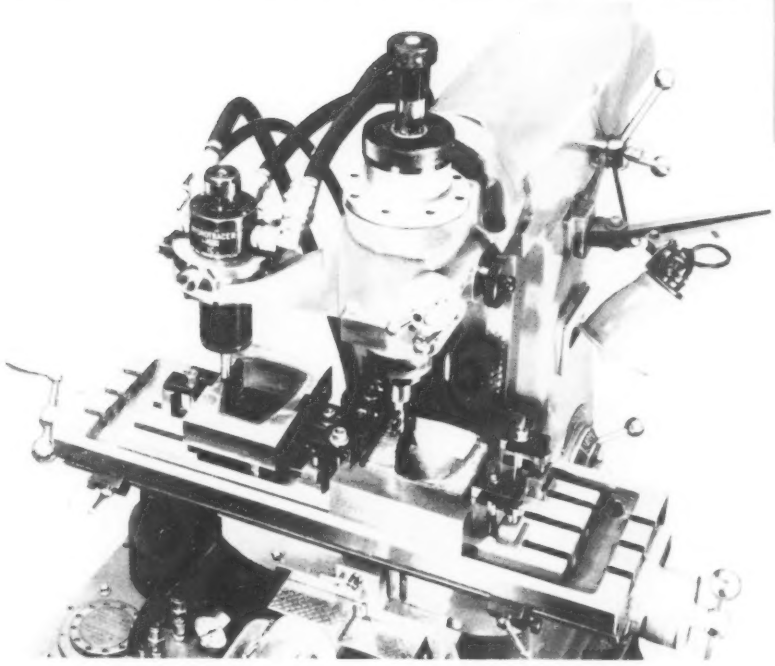

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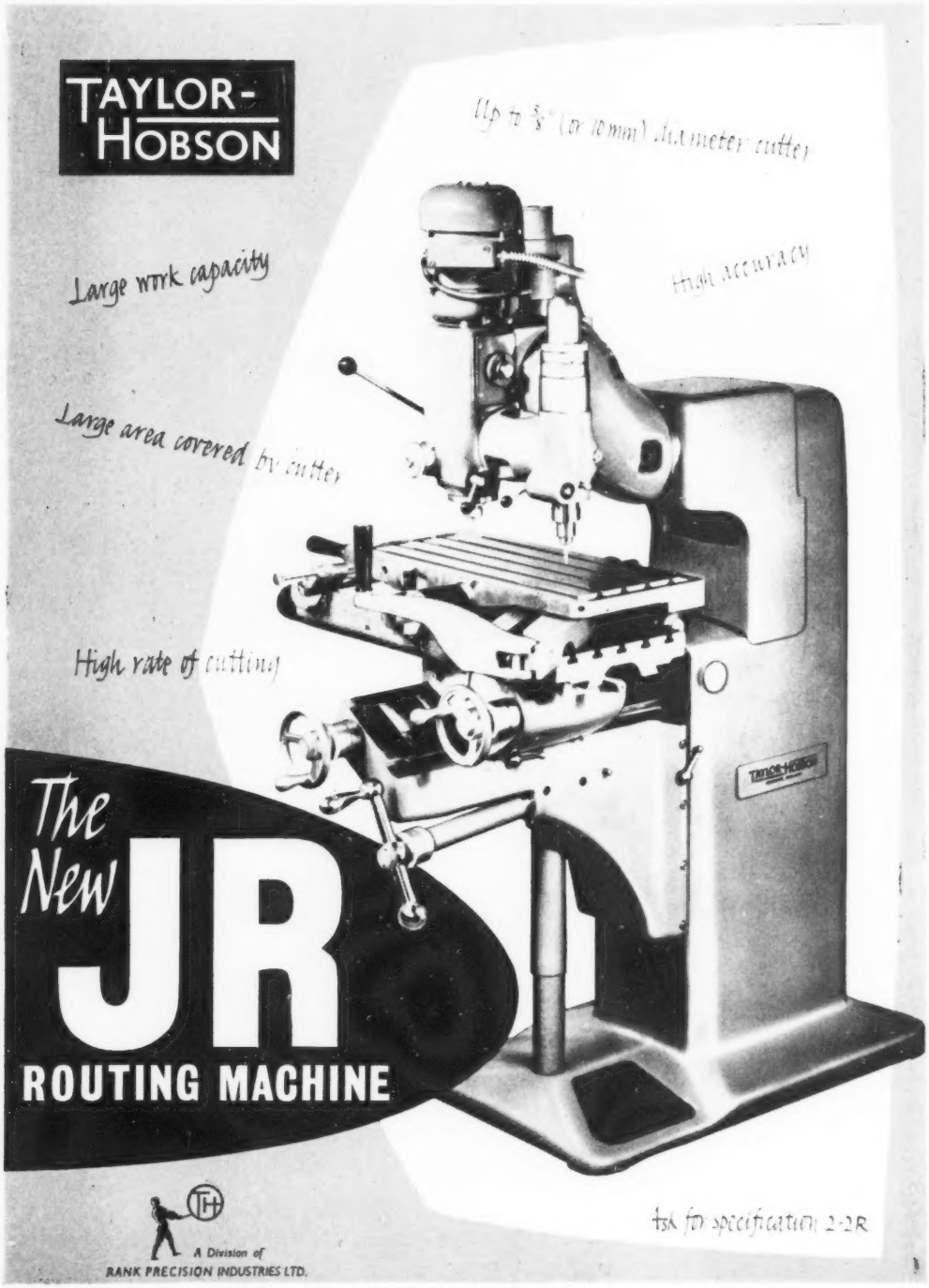

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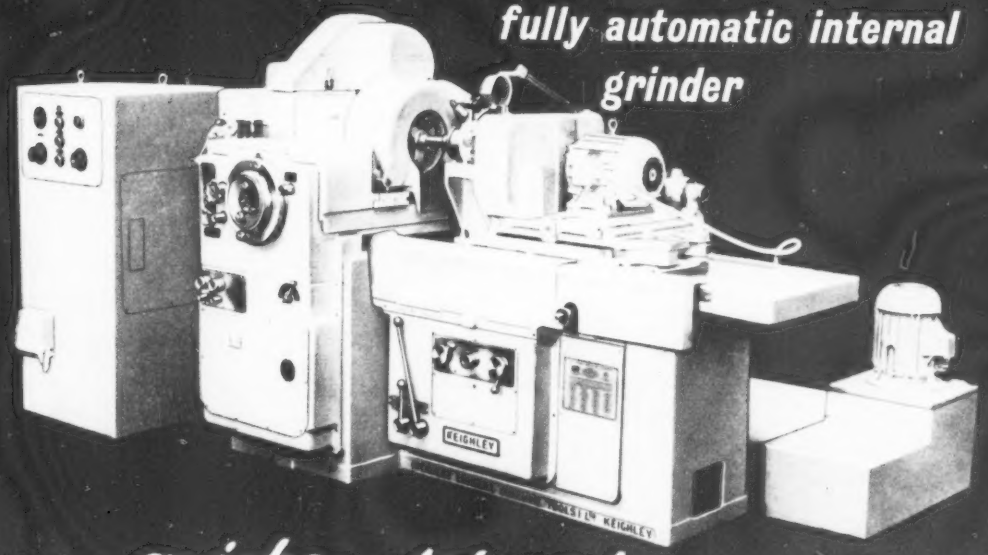
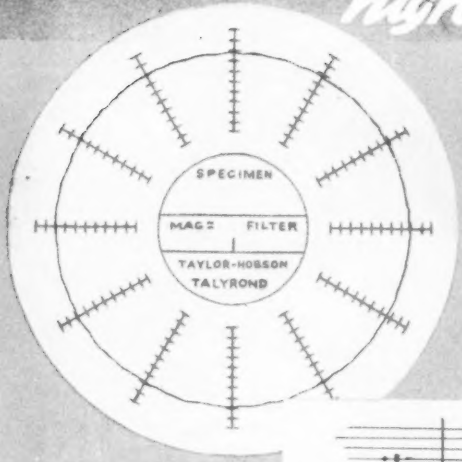
fully automatic internal grinder



quicker set-ups
faster cycles
higher precision

ONE OF THE NEWALL GROUP



Graph shows accuracy within 0.0002" achieved in production of a batch of components with 1⅛" dia. × ½" bore. Production rate—100/hour floor to floor, stock removal—0.008".

Roundness recorded by TALYROND—within 0.00004".

Precision built to exceptionally robust proportions, operated by single lever control after initial setting up, and arranged for both gauge and diamond sizing to ensure maximum utilisation, the fully automatic AK is unsurpassed for accuracy, component finish and fast cycles in grinding holes from ½" to 6" diameter with a maximum depth of 6", and for taper bores up to 90° included angle.

a quality product of
KEIGHLEY GRINDERS (MACHINE TOOLS) LTD

KG MACHINE TOOLS

NEWALL GROUP SALES LIMITED
PETERBOROUGH, ENGLAND
Telephone: PETERBOROUGH 3227 *Telegrams:* 'PRECISION' PETERBOROUGH

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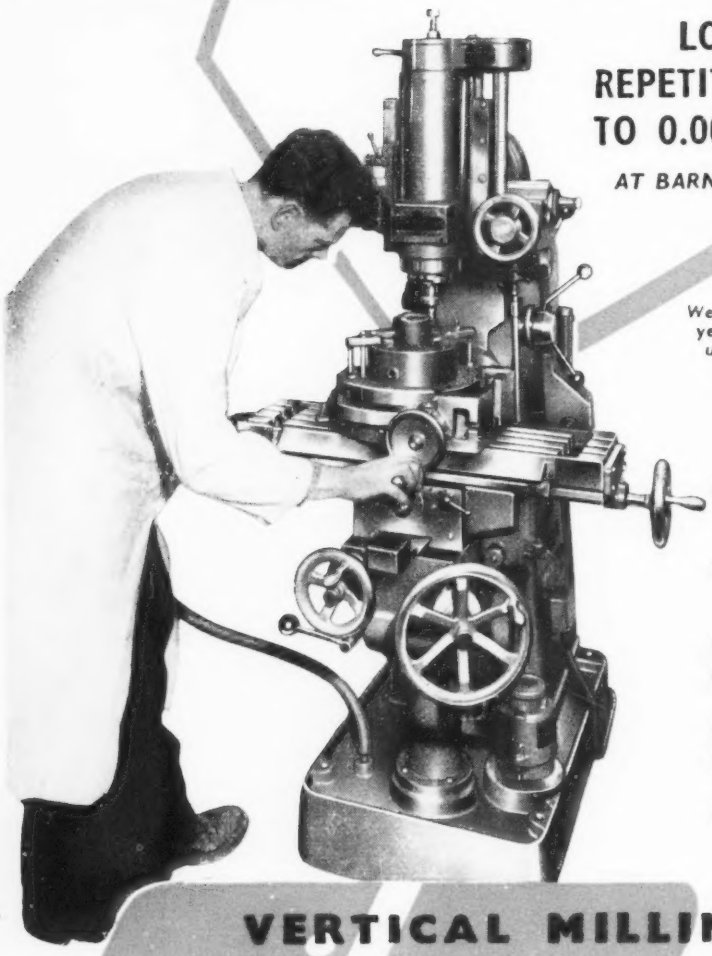
LOCATES WITH REPETITIVE PRECISION TO 0.0005"

AT BARNETT BROS. (GUILDFORD) LTD



We purchased this machine just over a year ago and it has been in constant use since then: it has given no trouble whatsoever.

We have the standard measuring equipment and with this we are spacing holes on jigs to ± 0.0005" of nominal position.

- Spindle hardened and ground on Timken precision roller bearings.
- Head with 3in. power down feed, can be swivelled through 360 deg.
- Table feed, automatic 18in
- Cross feed 6½in., vertical 14½in., both hand.
- Spindle to table 15in.
- Spindle speeds 50 to 1,000 r.p.m.
- Table working surface 30in. by 8½in.

VERTICAL MILLING MACHINE

WITH POWER DOWN FEED & GAUGE BLOCK MEASURING EQUIPMENT.

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- Constant horse-power transmitted throughout the speed range.
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- Exceptionally light, sensitive and accurate control of speed setting.
- Co-axial input and output shafts which rotate in the same direction.
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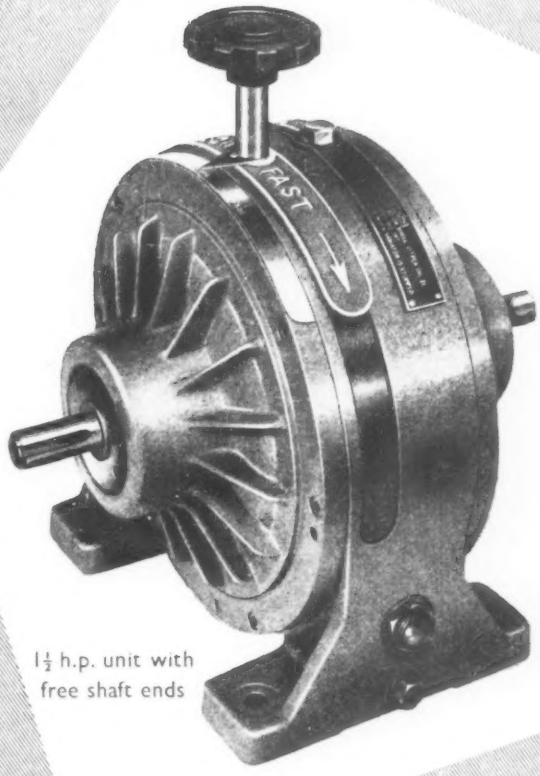
- Compactness, with consequent ease of mounting as an integral part of a machine.
- Vibrationless and silent performance.
- Standard range 1·33 h.p. to 15 h.p.



1½ h.p. unit with free shaft ends

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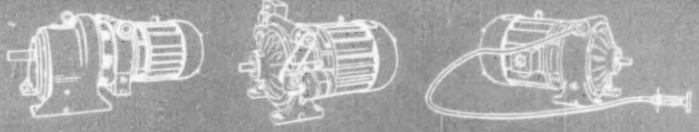

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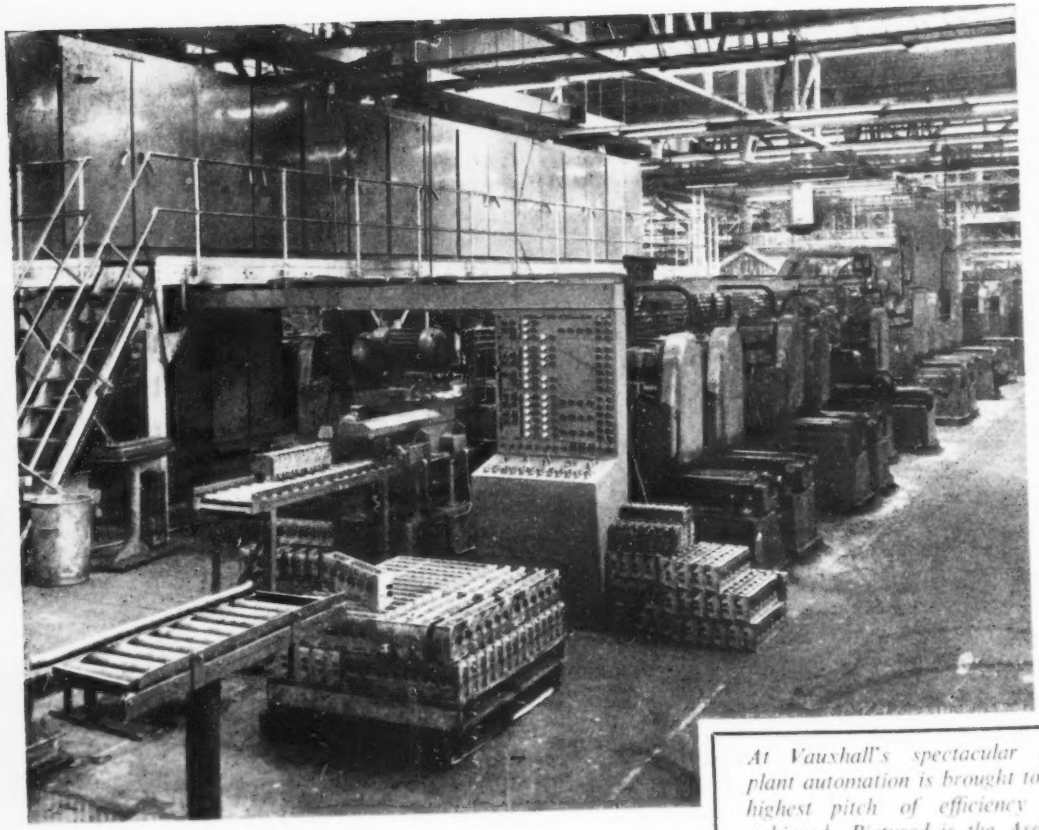
Automation at Vauxhall Motors



At Vauxhall's spectacular new plant automation is brought to the highest pitch of efficiency yet achieved. Pictured is the Asquith 18-station Drilling Transfer Machine used for machining all Vauxhall Victor, Velox and Cresta cylinder heads. With a total of 273 spindles it absorbs 269 H.P., cycling at 70 pieces hr. performing all drilling, reaming, countersinking, boring and tapping operations. The sequence of all the fixtures, transfer bar, tilting and turning stations is actuated by VICKERS-DETROIT *Oil Hydraulic Equipment.*

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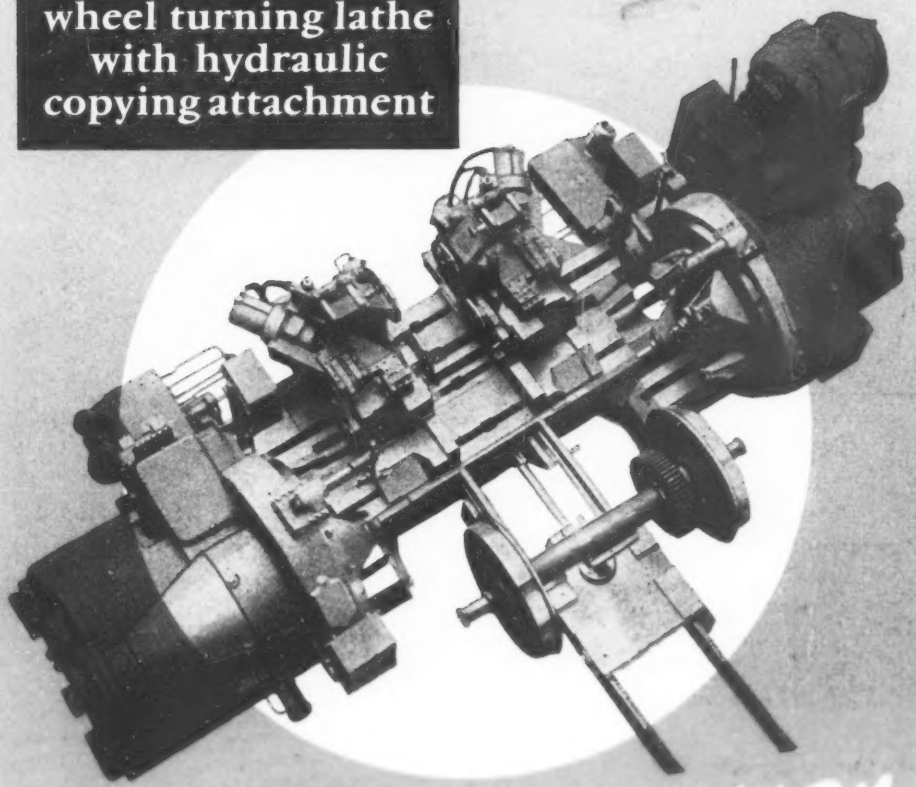
A new automatic wheel turning lathe with hydraulic copying attachment



a pair of mounted wheels 37½ Dia reprofiled in 6½ min.

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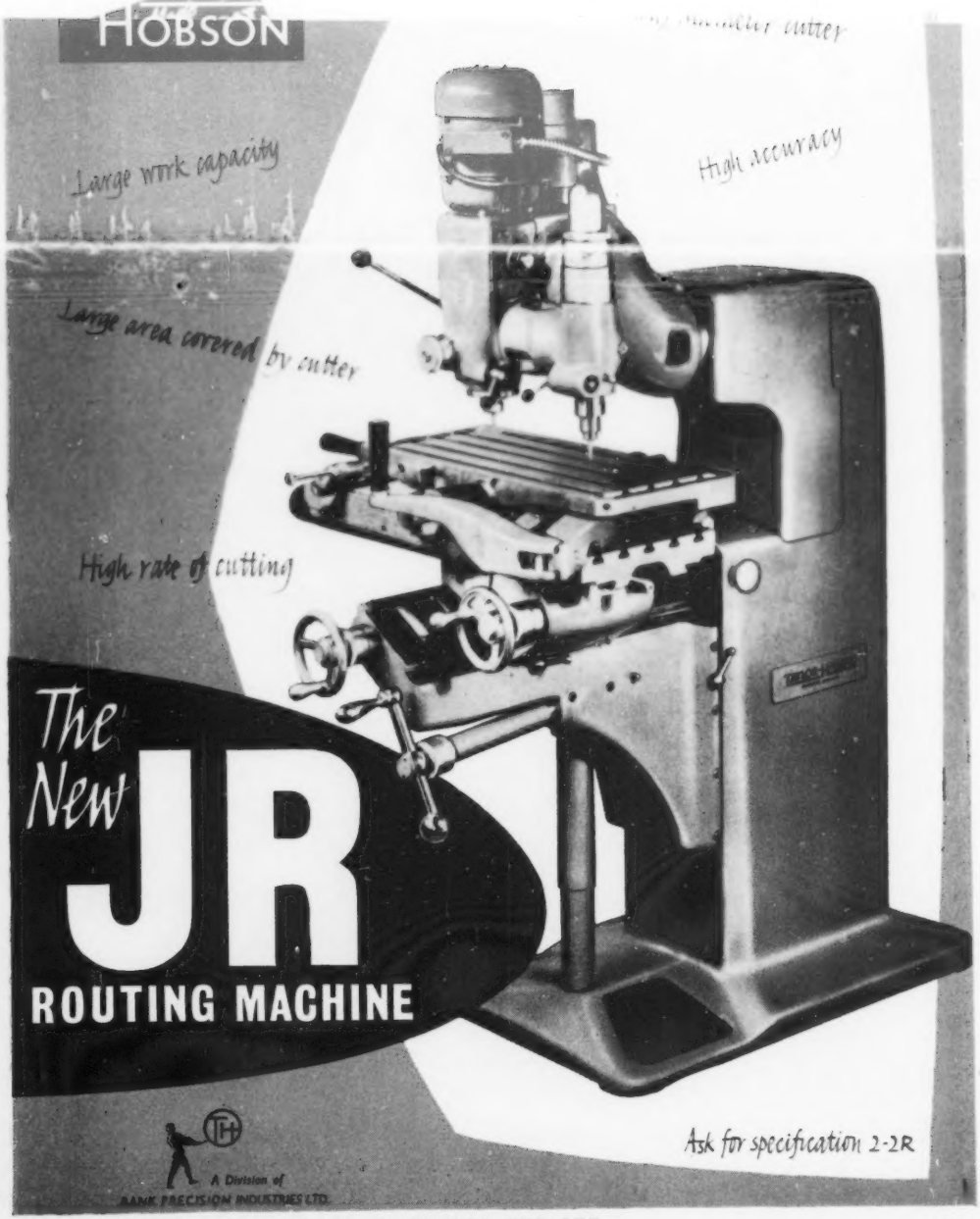

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faster cycles
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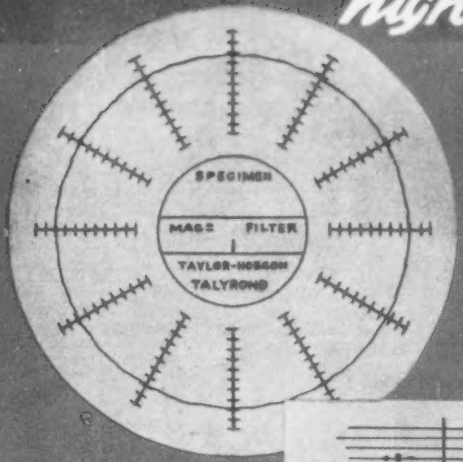

Graph shows accuracy within 0.0002" achieved in production of a batch of components with 1½" dia. × ¾" bore. Production rate—100/hour floor to floor, stock removal—0.008".

Roundness recorded by TALYROND—within 0.00004".

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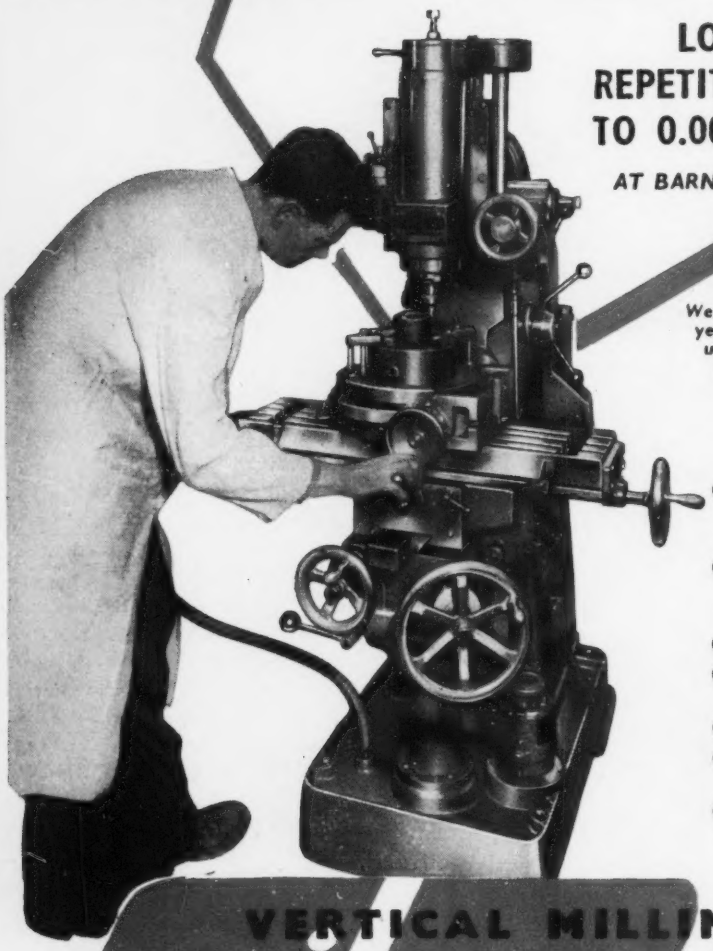

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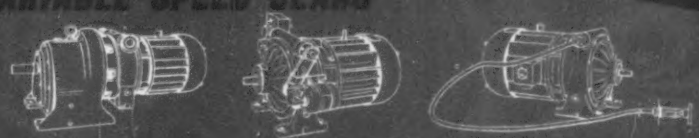

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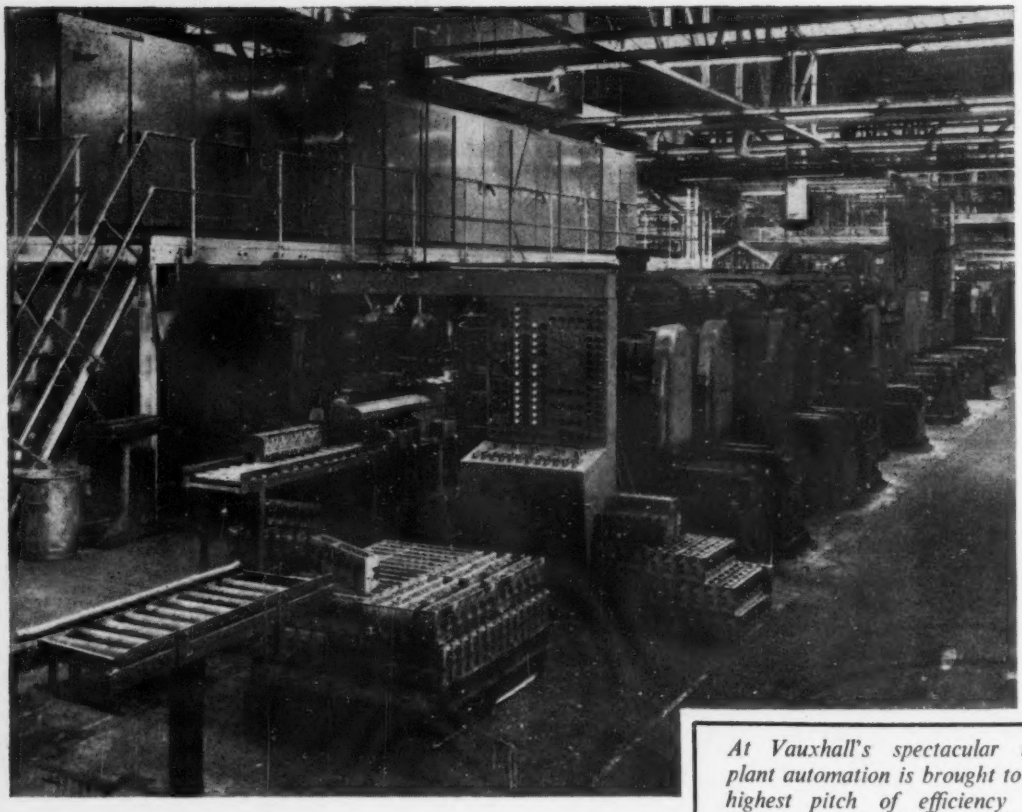
Automation at Vauxhall Motors



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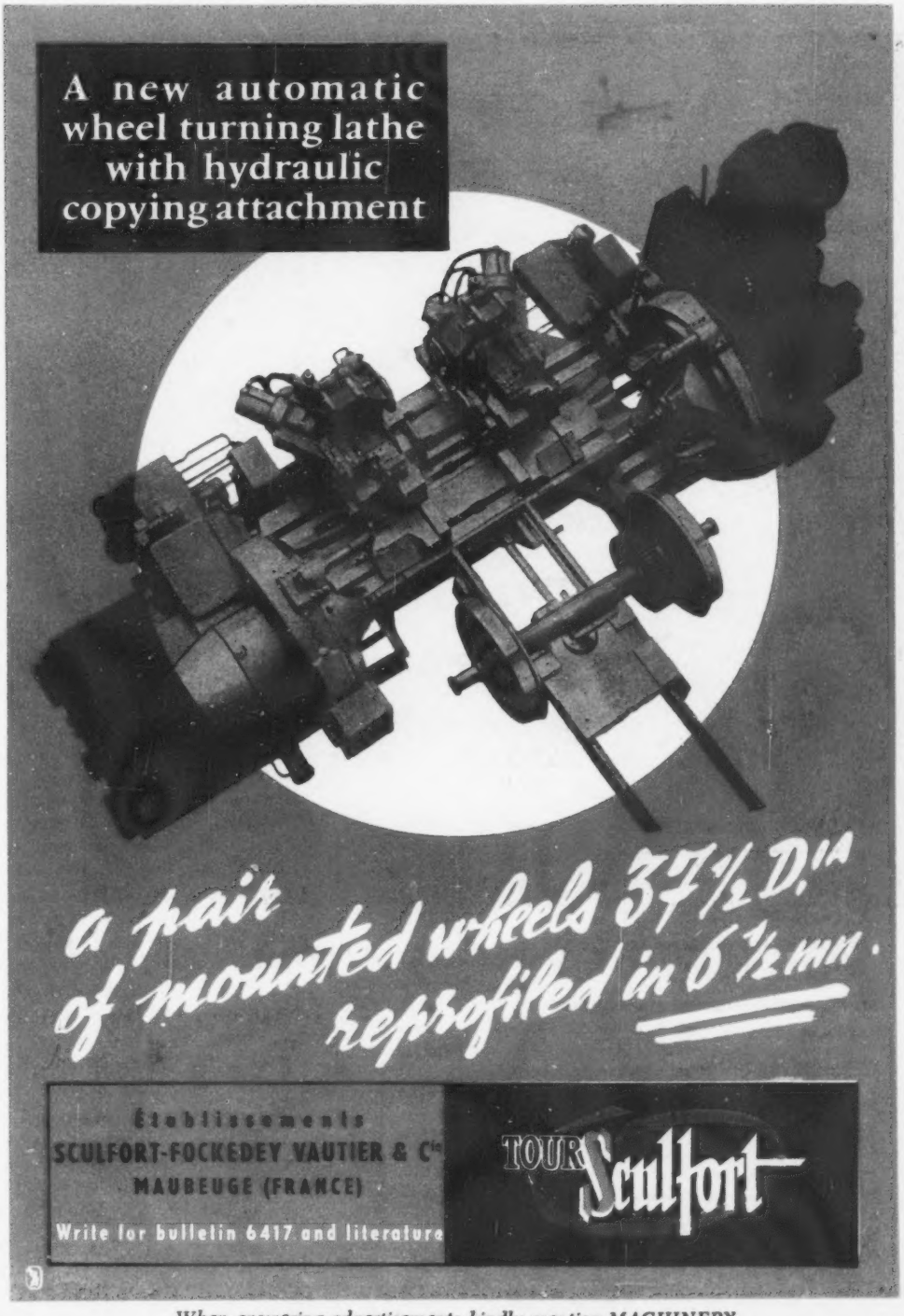
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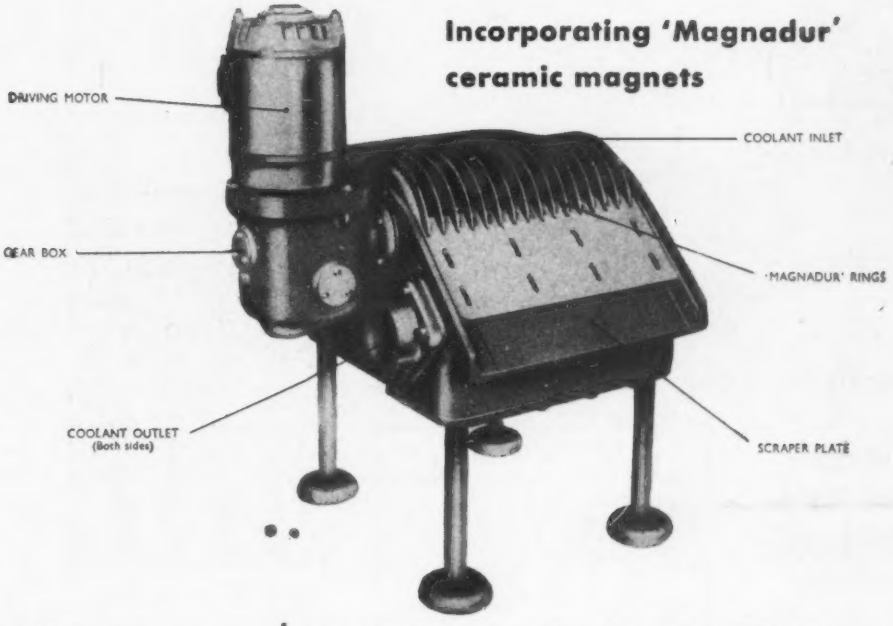
Incorporating 'Magnadur' ceramic magnets



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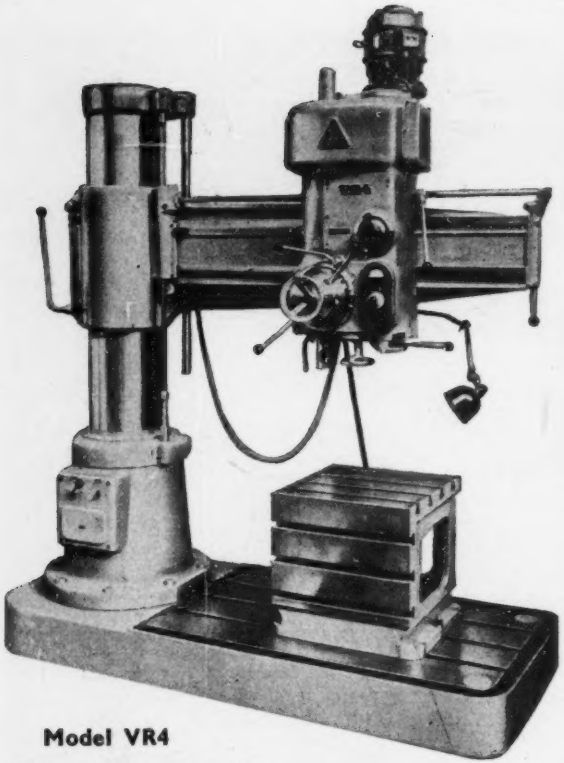

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SPECIFICATION	VR2	VR4	VR6	VR8
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Drilling Capacity in Cast Iron	1⅛in.	2in.	3⅛in.	4⅛in.
Maximum distance centre line of spindle to column	31⅛in.	49in.	79in.	99 in.
Minimum distance centre line of spindle to column	9in.	12⅛in.	17in.	19⅛in.
Maximum distance spindle nose to Box table	24in.	30in.	52in.	64in.
Maximum distance spindle nose to base	40in.	51in.	72in.	83in.
Vertical movement of arm on column	21in.	28in.	34in.	41⅛in.
Taper in spindle	3 M.T.	4 M.T.	5 M.T.	6 M.T.
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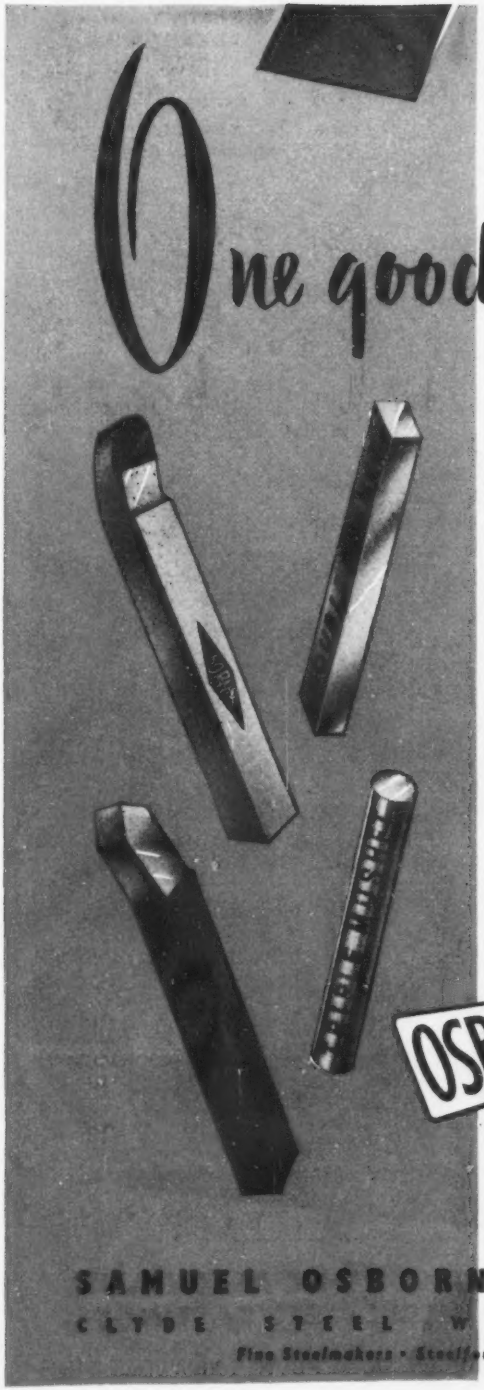

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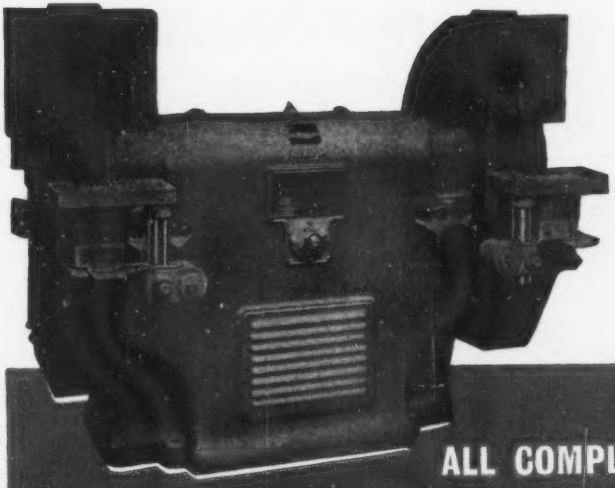

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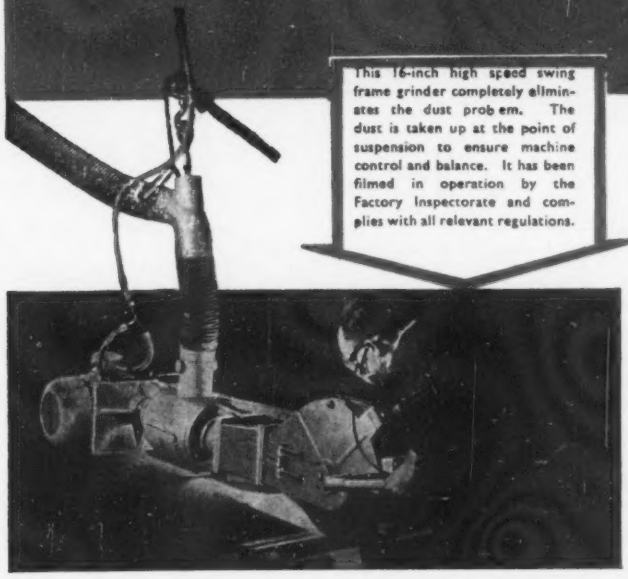

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Throat	12in.	12in.
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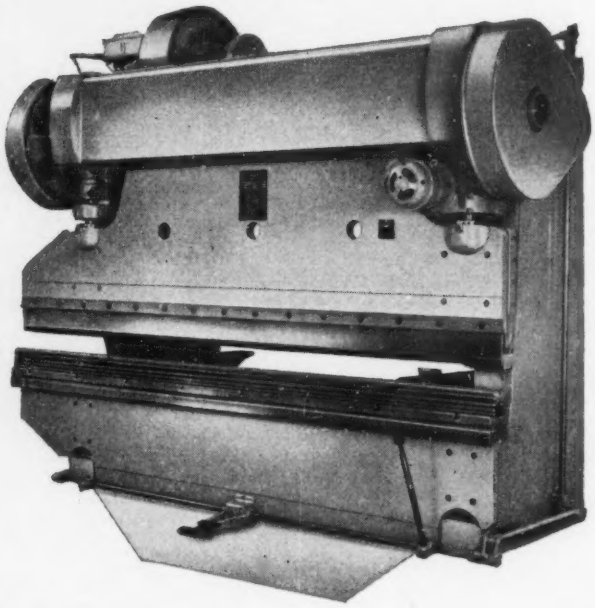

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P.1a

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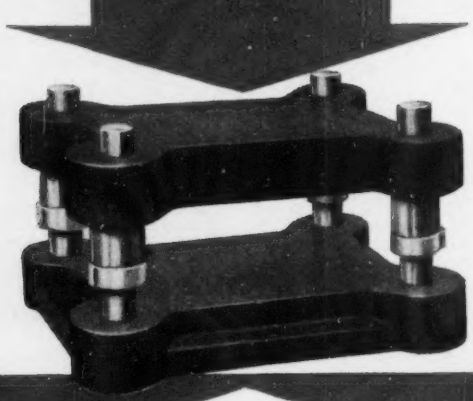

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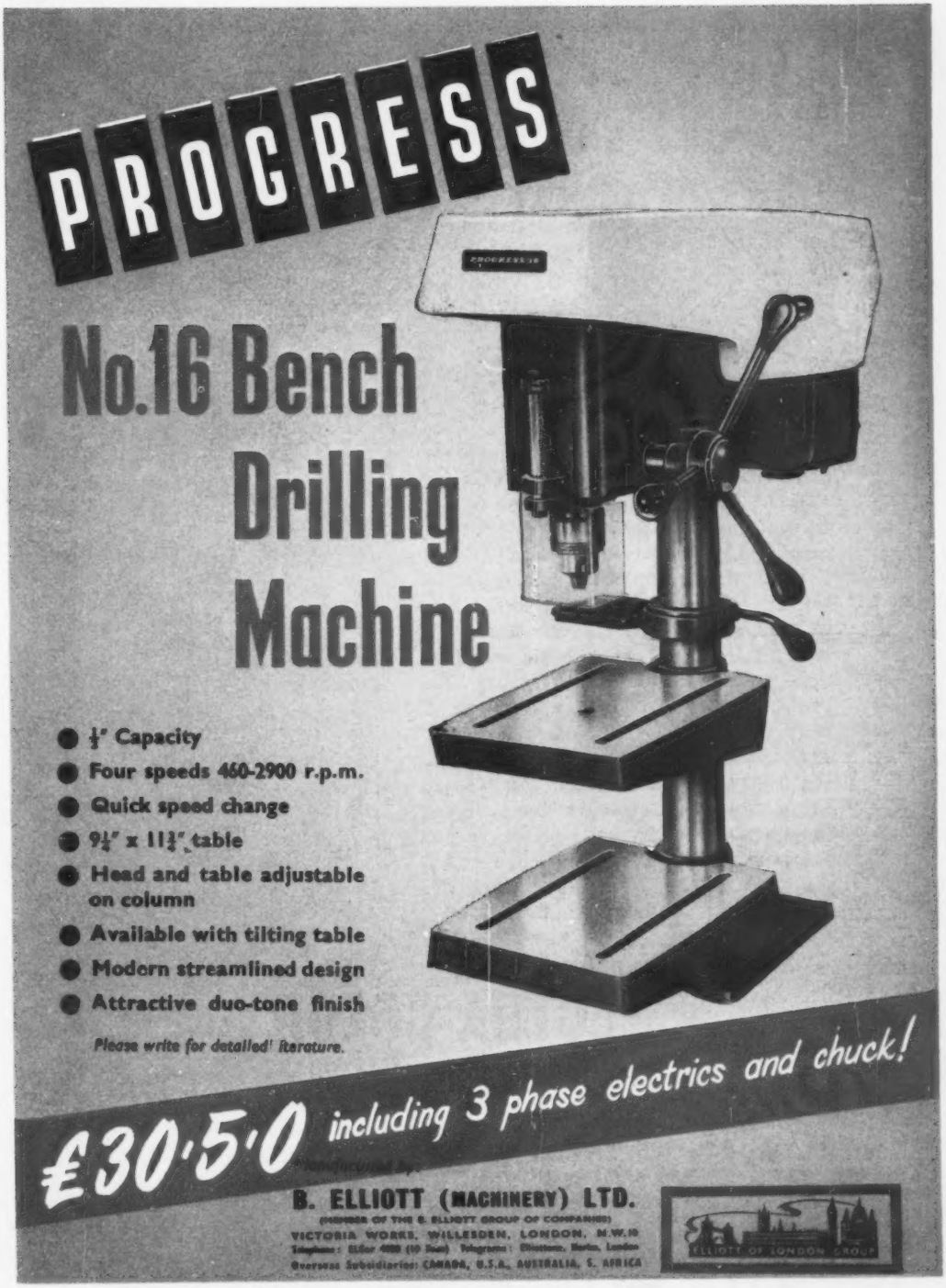
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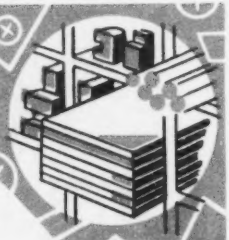

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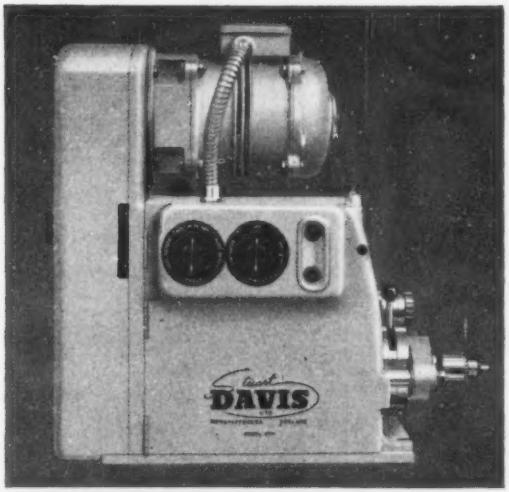

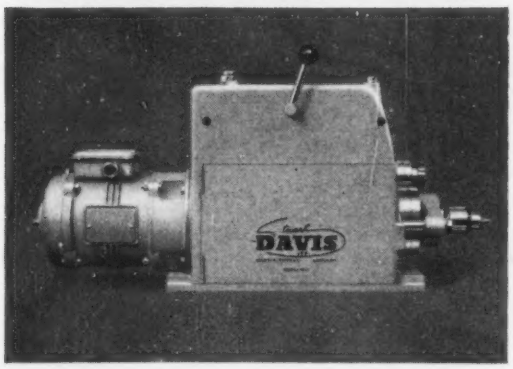

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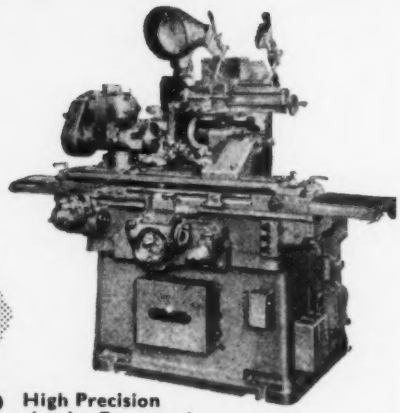

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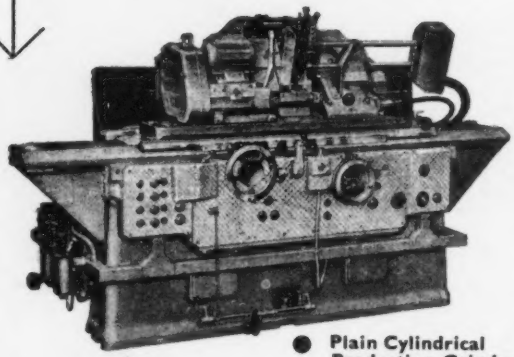

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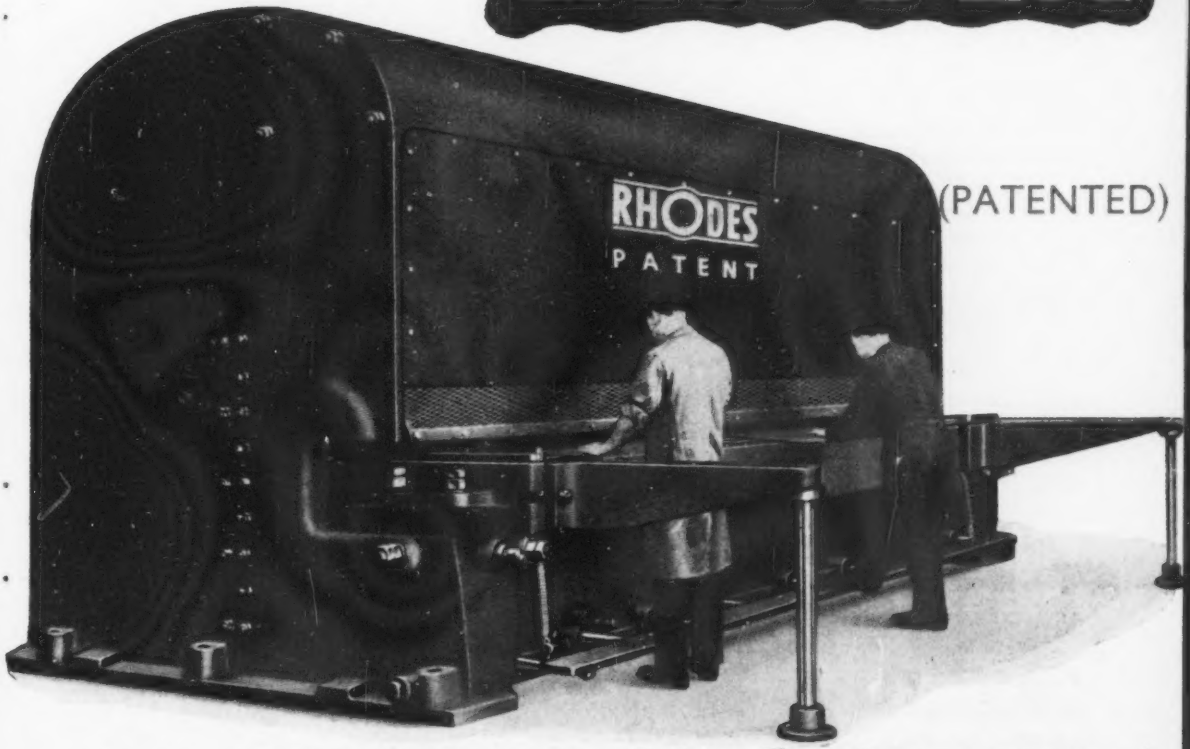

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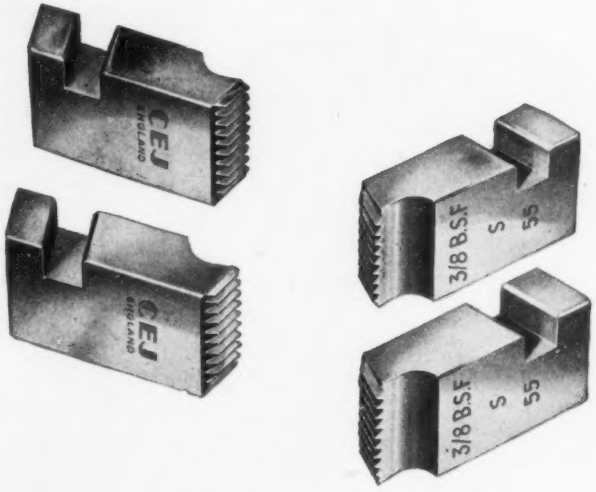

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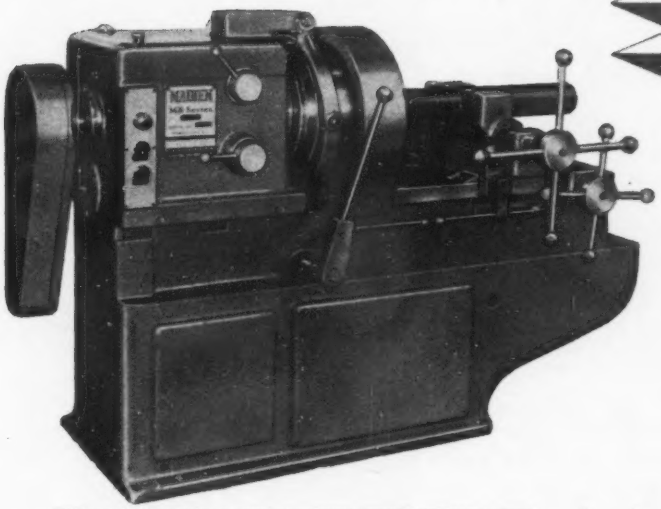

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4	1"–2"	1"–4"	12"	3 h.p.	12.5–104 r.p.m.
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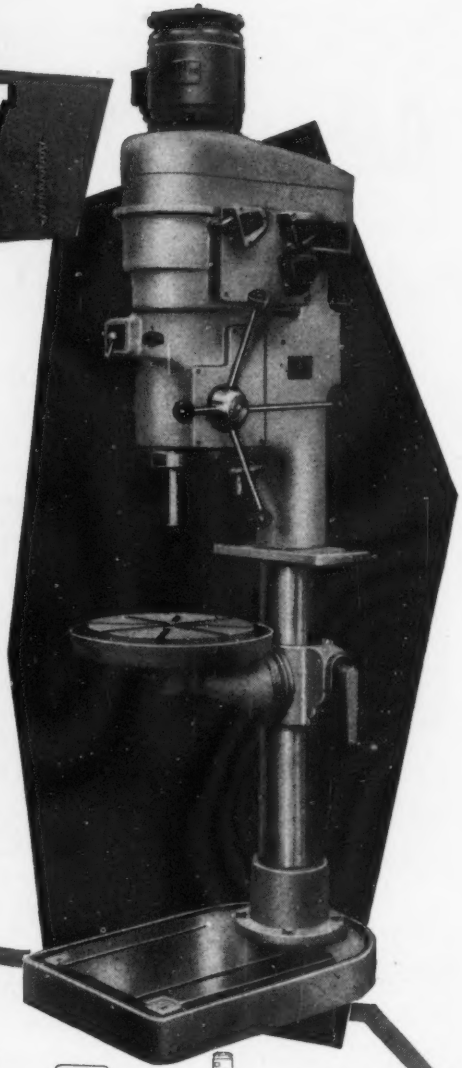

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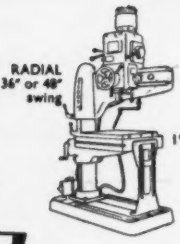

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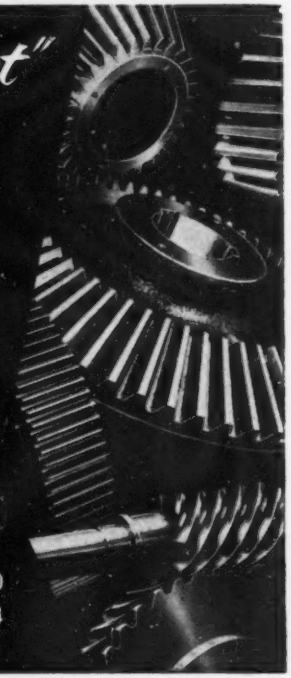

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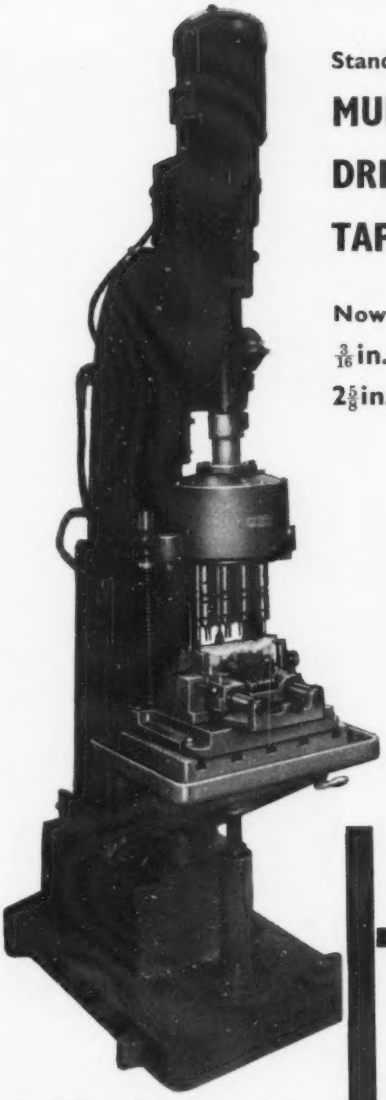

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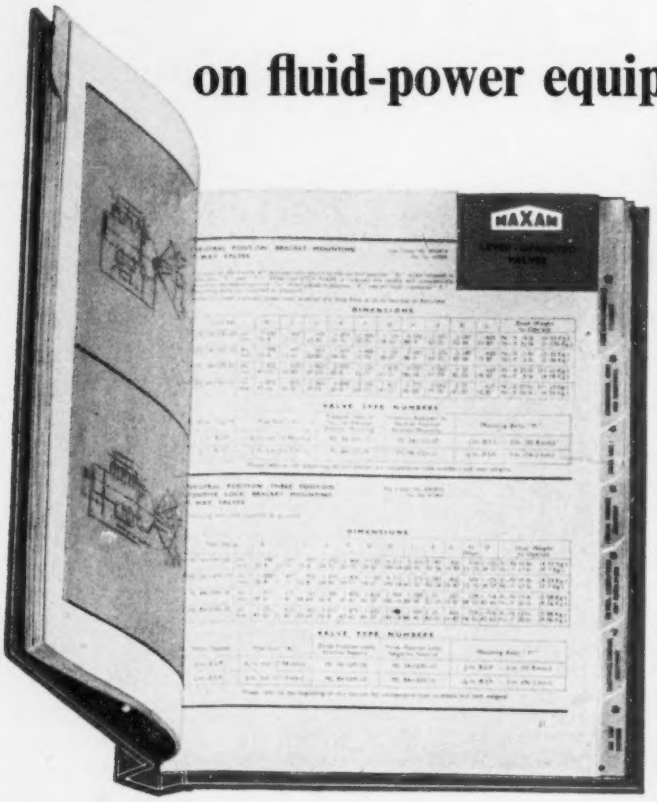

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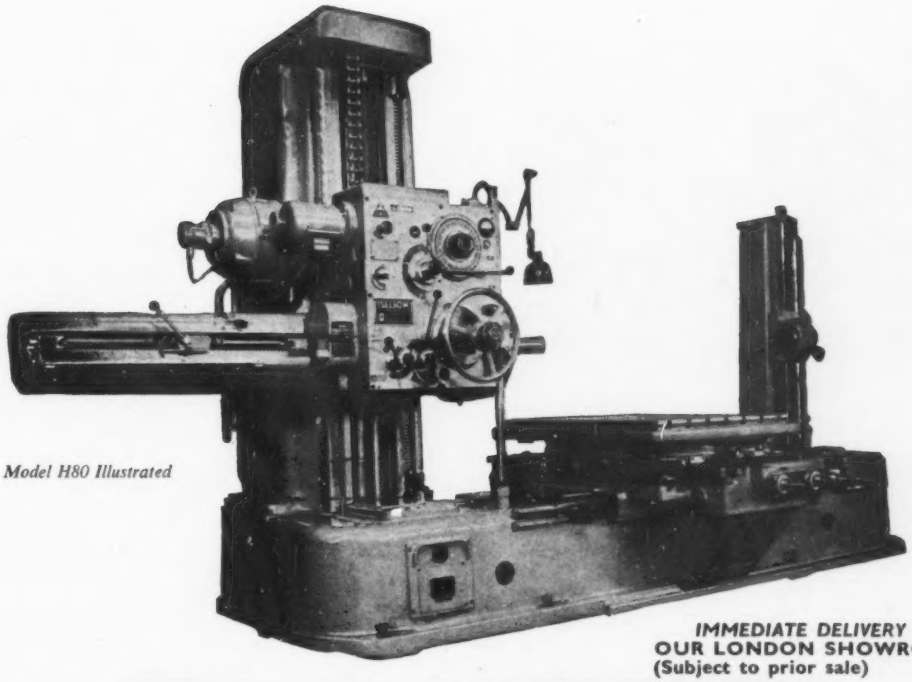

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Model	H63	H80	H100
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Number of spindle speeds	16	18	27
Range of spindle speeds: r.p.m.	8—1400	5.6—1000	2.8—710

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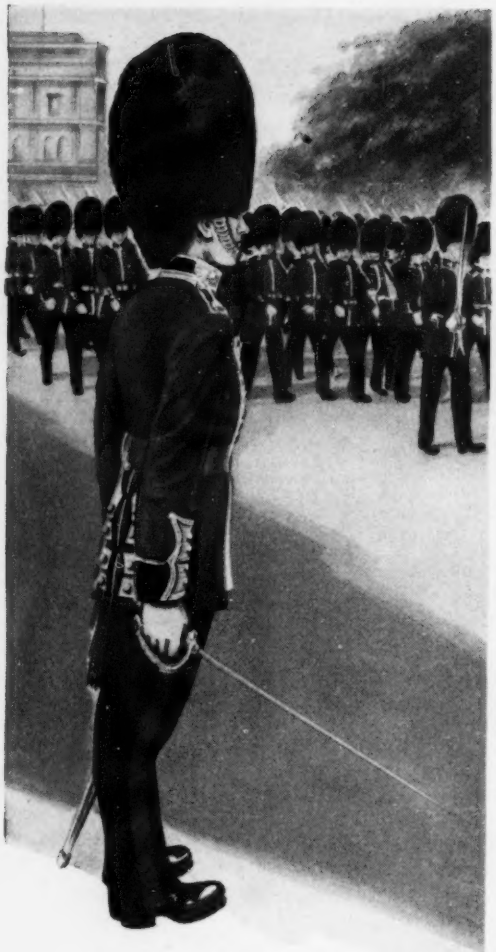

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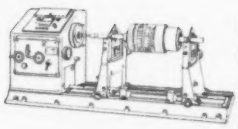

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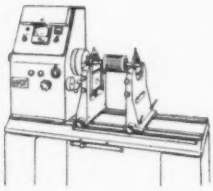
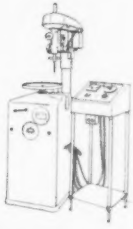


Model UA. 10 and 30 for components from 0.22 lbs. to 66 lbs.



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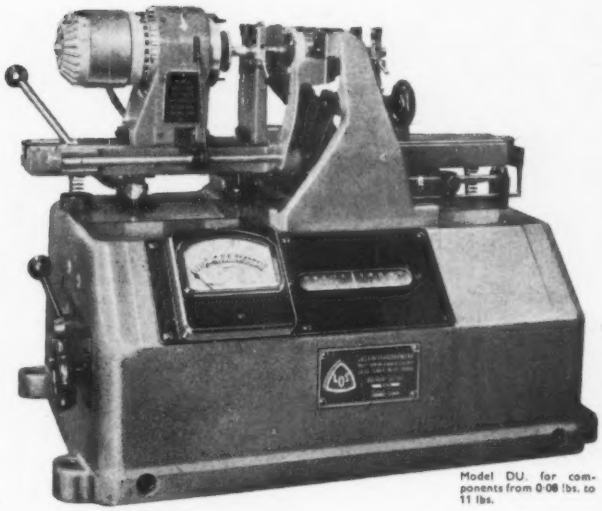

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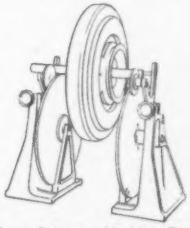

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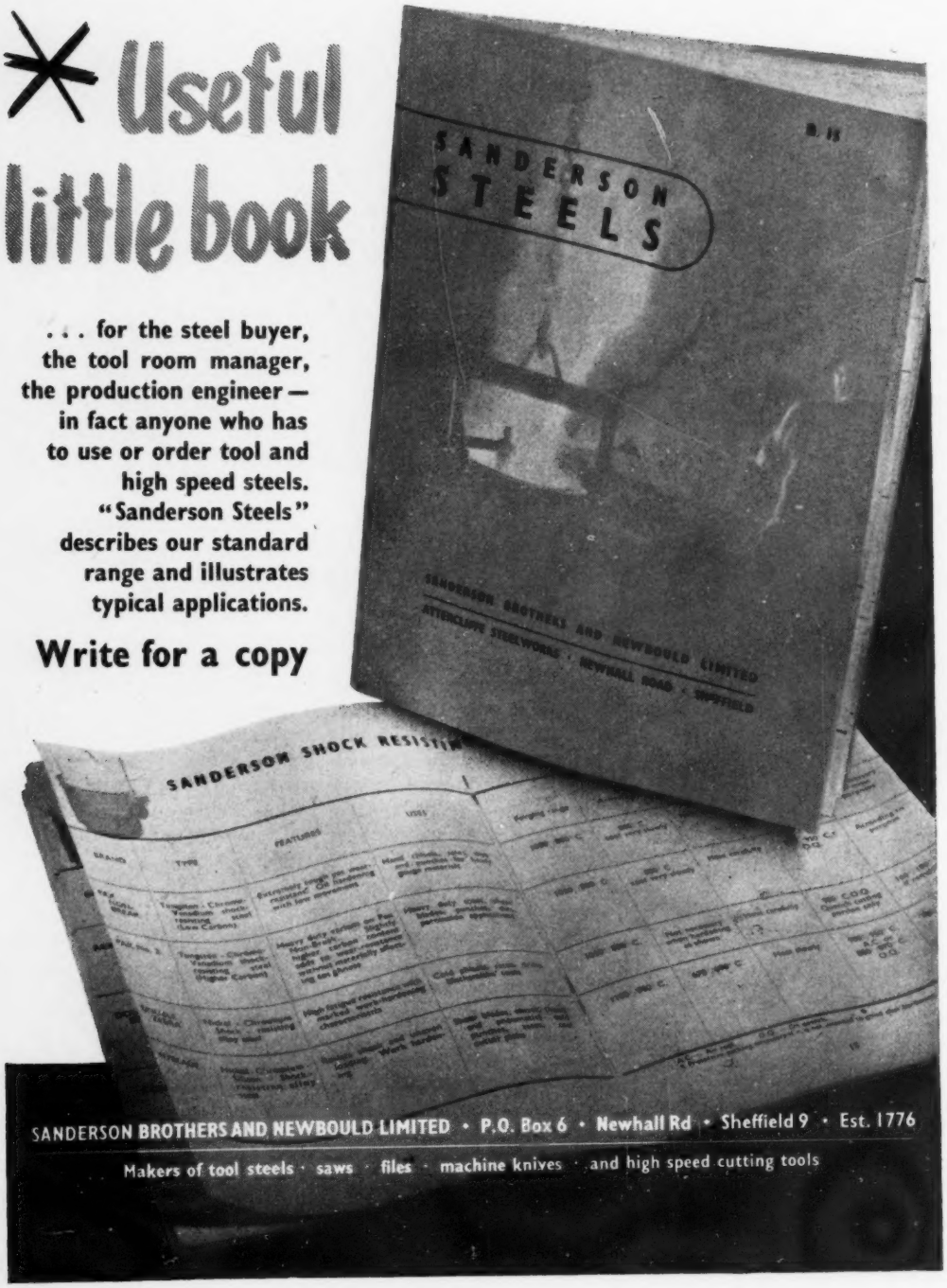
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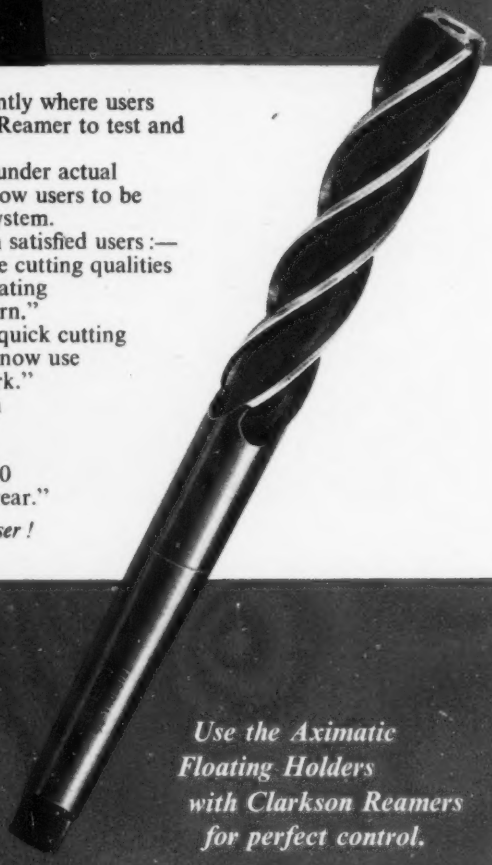

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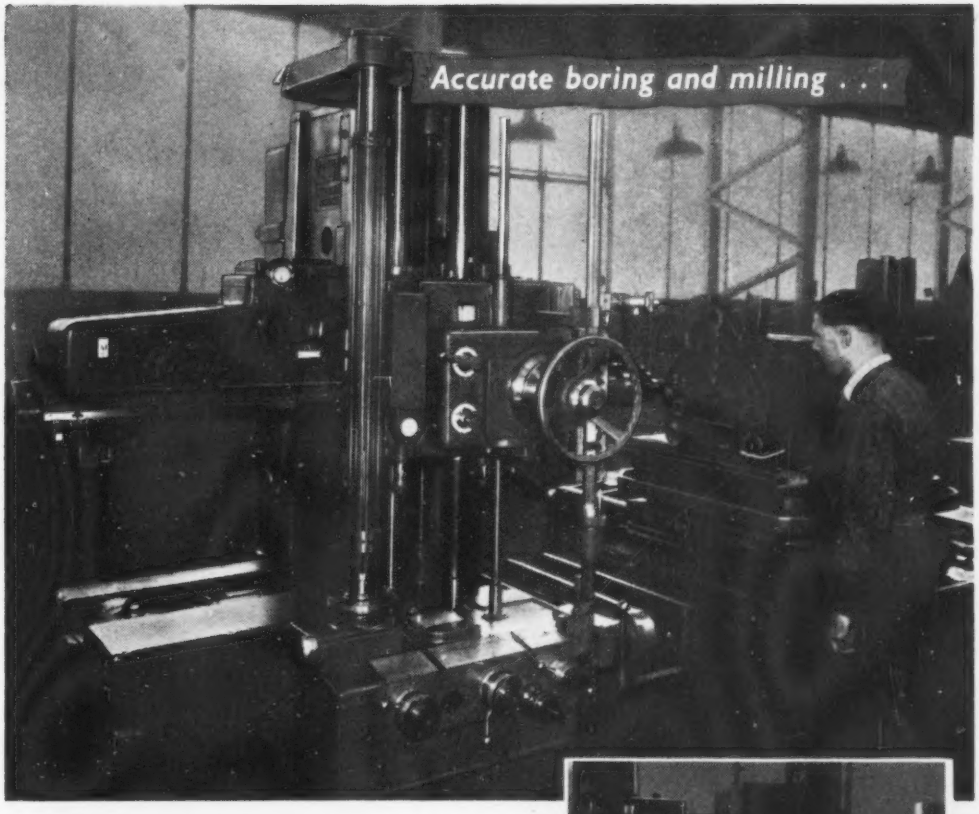
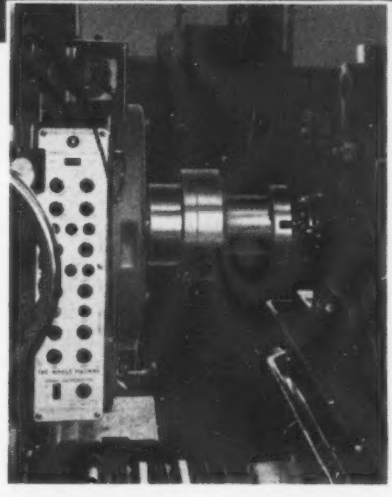


. . . and the advantage of preselected positioning

The Ceruti "Alematic" Horizontal Boring Machine shown here is installed in the Cinderford Works of R. A. Lister & Company Limited. In this instance, it is boring and milling the faces of a jig plate, but the machine is frequently used for batch work where the automatic positioning device is of particular advantage. Up to 15 positions can be preselected to repeat to the settings accomplished by optical measuring devices for the first workpiece. The need for jigs, in many cases, can thus be eliminated. Dia. of boring spindle $3\frac{5}{32}$in., Revolving Table $36\frac{7}{32}$in. by $36\frac{7}{32}$in.



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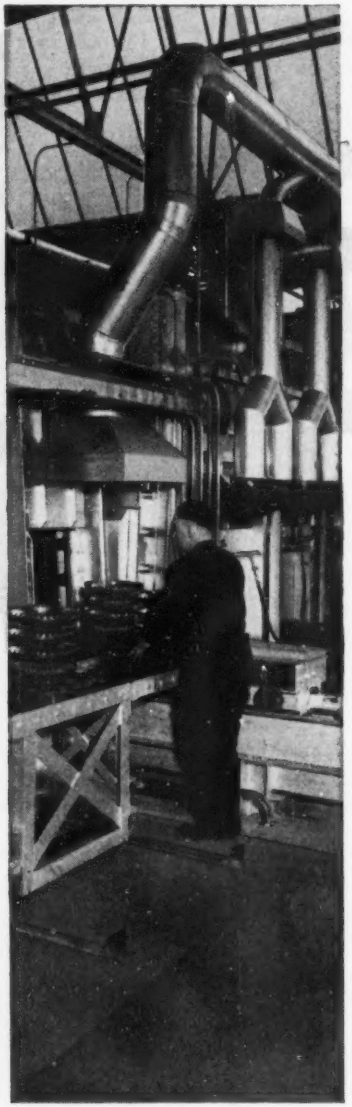

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Abstracts of Principal Articles

Producing the Vauxhall Victor ... P. 1036

This article describes the operations involved in the production of rear axle tubes and half-shafts at the works of Vauxhall Motors, Ltd., Luton. The axle is of composite construction with a central cast housing into which are inserted two tubes to enclose the axle shafts. After some preliminary operations on the tube and the end flange, the two are welded together on a Bode circumferential machine, by the submerged arc method. A number of attachments, including spring seats, are then welded to the tubes, after which they are machined at each end on a special Archdale trunnion-type machine. The axle half-shaft has a flange at one end, and the forging is faced and centred before being turned on Churchill-Redman automatic profiling lathes. Spline serrations on the small end are rolled into the shaft surface on a Michigan Roto-Flo machine arranged for automatic operation. The flange is next turned, and a special Archdale machine is employed for drilling, reaming, and tapping the various holes required. Surface hardening of the shaft is carried out on an Efco automatic high-frequency unit, and tempering in a Wild-Barfield pit-type furnace. Shot-peening in a special Spenstead unit follows, after which certain diameters are ground to size and the shafts are inspected for cracks on a Fel-Electric machine. (MACHINERY, 93—5/11/58.)

I.C.I. Automatic Austempering Plant for Imperial Typewriter Components P. 1046

In the Leicester and Hull factories of the Imperial Typewriter Co., Ltd., I.C.I. automatic austempering plants are installed which provide for very efficient heat-treatment of type bars and a variety of other typewriter components made from high-carbon steel. The austempering process produces a bainite grain structure and not the more brittle martensite structure, and a hardness of 50 Rockwell C is obtained. Details are here given of the construction and operation of the plant, which has an output capacity of 10,000 type bars per hour, and is tended by only one operator, with two girls engaged in loading the work trays. (MACHINERY, 93—5/11/58.)

Production Jig Boring ..... P. 1051

At the works of the Newall Engineering Co., Ltd., Old Fletton, Peterborough, a line of 9 Newall jig borers is employed for the batch production of a wide range of machine tool components, and it is stated that by using such machines in this manner, considerable savings have been effected. To ensure efficient machine utilization, a system of pre-production planning is employed, and the machine operators are relieved of as many non-productive duties as possible. Various aids to storing tools in an orderly manner, for ready accessibility, have also been introduced. Machining processes employed on the line, such as shave milling, dovetail milling, and boring, and their applications to some typical components, are discussed. (MACHINERY, 93—5/11/58.)

Plant for Pre-painted Steel Strip... P. 1061

Coated Strip, Ltd., Bescot, Walsall, has recently been established for the production of steel and aluminium strip up to 16 in. wide, in gauges from 0·005 to 0·040 in. thick, which is continuously coated on both sides with paint or lacquer. Supplied in coil form, the strip is coated in a special plant at speeds up to 60 ft. per min. First, it is passed through a 6-stage degreasing and pre-treatment section, the latter stages of which incorporate phosphate and chromate rinsing tanks. At the end of this process, the strip is turned through 180 deg. to proceed through the second part of the line, which is arranged parallel to the first. After passing through deburring rollers, the strip enters the coating machine, where the paint or lacquer is applied, and is then fed through a 60-ft. long drying oven. On leaving this oven, the strip is cooled by water sprays, and, finally, is recoiled. The paints used have been specially developed, to ensure good adhesion and ductility. (MACHINERY, 93—5/11/58.)

Mécanélec Exhibition, Paris–1 ..... P. 1067

Reference has already been made in MACHINERY 93—5/11/58 to some of the features of the Centre Nationale des Industries et des Techniques, Paris, which is in an advanced stage of construction, and is stated to be the largest exhibition hall of its kind in the world. To mark the progress that is being made with this project, an inaugural exhibition, Mecanelec-58, was held from September 12 to 21. Machine tools and production equipment formed an important part of the exhibits and details are given here of some recent developments of interest, including an H.E.B. type S Pilote copying lathe, a Sculfort heavy-duty centre lathe, Precimo hobbing machines with magazine loading, spark erosion equipment by Qualitex and Mape, Stop Cote electronic gauging equipment, a Dufour profile milling machine for turbine blades, a Blume & Redecker fully automatic coil winder, and a Renault transfer machine for cylinder heads. (MACHINERY, 93—5/11/58.)

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

IN FORTHCOMING ISSUES

Aspects of Russian engineering industry.

A Second Language

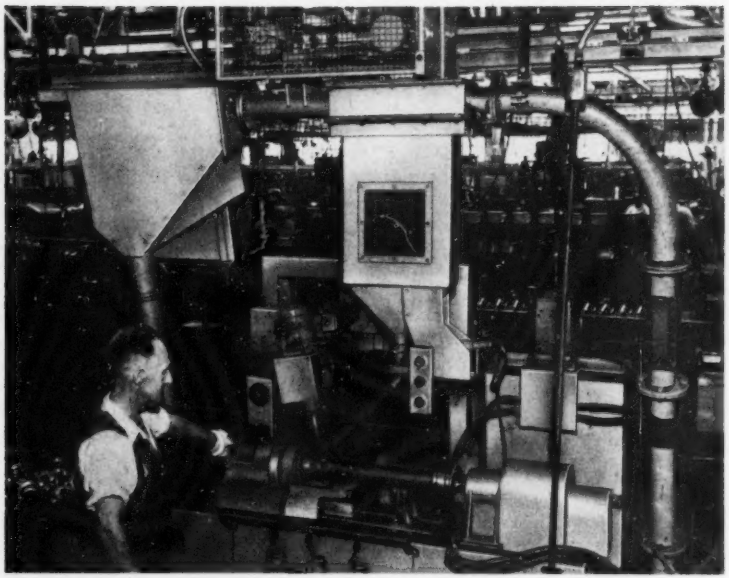
During the past 50 years, the science and practice of engineering have developed and expanded at an ever-increasing rate, and particularly since the end of the second world war the advances that have been made in all branches have been many, varied, and far-reaching. Although there has been a growing tendency for engineers to specialize, no branch has developed in isolation, and the progress that has been achieved in one field has almost invariably influenced others. An example of this type of "chain reaction" is afforded by the gas turbine, the development of which led to the introduction of new heat and corrosion resistant alloys which, in turn, have necessitated improved cutting materials and techniques. Once the large scale manufacture of gas turbines was initiated, moreover, new high production methods had to be devised in order that components of the required standards could be made available in the necessary quantities. The materials and techniques that have been introduced, however, are not now applied solely to the production of gas turbines, but are being used to an increasing extent in many different fields.

Just as one branch of engineering cannot develop fully alone, but must be influenced by, and contribute to, advances in other fields, and, indeed, in other industries and sciences, so should the work of engineers in all branches in one country be influenced by developments that are being made elsewhere in the world. If this condition is not fulfilled, many laborious and time consuming investigations may be duplicated, at least, and valuable energies wasted. It is not suggested that the engineers of any one country should imitate those of another, or should apply themselves only to development work that has not been undertaken elsewhere. It cannot be emphasized too strongly, however, that engineers at all levels should keep abreast of developments in their own and allied fields, both in their own country and abroad, and should pursue their own work in the light of such developments. In this respect, British engineers are particularly fortunate, since their language is used in some other industrial countries, of which the most important is the U.S.A. In consequence, British engineers can study the latest information relating to the many new practical and theoretical discoveries that American workers are making in all branches of engineering and the allied sciences, almost as soon as it is published.

On the other hand, engineering development is by no means limited to the English-speaking countries, and it should therefore be the ambition of every competent engineer to be able to read technical literature written in at least one language other than his own. The choice of language to be studied must depend on a number of factors. At first glance, the universal language Esperanto might appear to be the most profitable, but there are certain difficulties which must tend to limit its usefulness for the purpose that we have in mind. Since the technical literature of any country must first be published in the native language, it would still be necessary for articles and papers to be translated, if they were to be read by Esperanto-speaking engineers. It seems unlikely, moreover, that any organization would be able to publish a technical journal in Esperanto, at least for many years to come, which would cover a sufficiently wide field, and still be economical.

The choice of a second language, therefore, appears to be restricted to those used by the more highly-developed industrial nations. At one time, the language chosen by most engineers would have been German or French, with the majority probably favouring the former. The contributions that both countries have made, and are still making, to engineering and the allied sciences are too well known to need emphasis here, and either language would still be a wise choice. In recent years, however, the Soviet Union has risen to an eminent position among the industrial nations of the world, and is likely to advance to even greater heights. This rise has been accompanied by intensive investigation and development of engineering theory and practice, particularly in the heavy engineering and production fields. Details of these investigations, and descriptions of the new techniques and equipment that result are presented in the many general and specialized journals of the Russian state technical publishing organization, most of which can be obtained in this country. Very few British engineers can read Russian, however, and the majority are therefore not in a position directly to assess the significance of these developments and compare them with their own work.

(*Continued on page* 1087)



Producing the Vauxhall Victor

Machining Operations on Rear Axle Components

Other articles* in this series have been concerned with the new design features incorporated in the Vauxhall Victor car and with the advanced methods employed by Vauxhall Motors, Ltd., Luton, for the production of gearbox components, stub axles, and rear axle housings, also with the layout of the new press shop which was recently completed as part of the firm's £36-million expansion scheme. Here, details are given of some of the more interesting operations on other rear axle components including tubes and shafts. As explained in the most recent of the articles referred to below, the axle for the Victor car is of composite construction, incorporating a malleable cast iron housing for the differential mechanism, with bosses at the sides for the insertion of tubes which enclose the wheel-driving shafts.

OPERATIONS ON REAR AXLE TUBES

Some dimensions and the shape of the right-hand rear axle tube, in the condition in which it is ready to be pressed into place in the axle housing, are shown in Fig. 1. Apart from the pressed steel spring seat and various minor items which are welded in position, the main components comprise the tube and the tube flange *A*, the latter being welded to one end. Rear axle tubes are cut to slightly more than the specified length from seam-welded stock of 2¼ in. outside diameter, with a minimum wall thickness of 0·1 in., before being supplied to the machine shop. These tubes are loaded into a single-spindle horizontal boring and facing machine of the company's own construction, in which they are bored to a diameter of 2·045/2·050 in. for a short distance, and faced.

Preliminary operations on the mild steel forging for the axle tube flange include rough- and semi-finish-boring and facing operations, performed on a pair of B.S.A. 6-in. capacity, 6-spindle chucking automatics. The tubes and flanges are then passed to a self-contained unit adjacent to the axle assembly area, where tubes are assembled by welding on the Bode automatic-cycle circumferential machine shown in Fig. 2. This machine provides for welding the flange to the tube by the submerged arc process, and the installation includes a 600-amp. rotary converter supplied by the

* MACHINERY, 92/760–4/4/58; 92/944–25/4/58; 92/1316–6/6/58; and 92/1432–20/6/58.

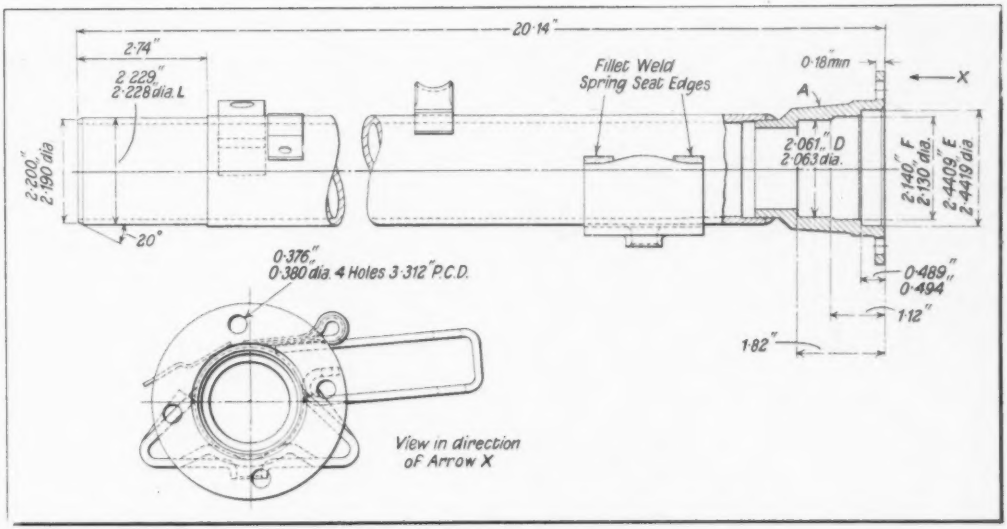


Fig. 1. Axle tubes for the rear axle of the Vauxhall Victor car are made by welding machined flanges to lengths of seam-welded steel tubing. Details of the right-hand tube are shown here

Lincoln Electric Co., Ltd. The machine has a bed of weld-fabricated steel construction, and at the left-hand end there is a spindle housing mounted on two horizontal cylindrical bars, which are supported in brackets attached to the bed.

The ram of an air cylinder at the left-hand end of the bed is connected to the spindle housing, and serves to move it longitudinally, to facilitate loading and unloading. At the right-hand end of the spindle there is an expanding chuck, operated by an air cylinder at the left, which grips the bore of the axle tube flange when it is loaded. The spindle also carries a large spur gear which is driven by a wide-face gear at the rear. At the right-hand end of the bed is another spindle, which

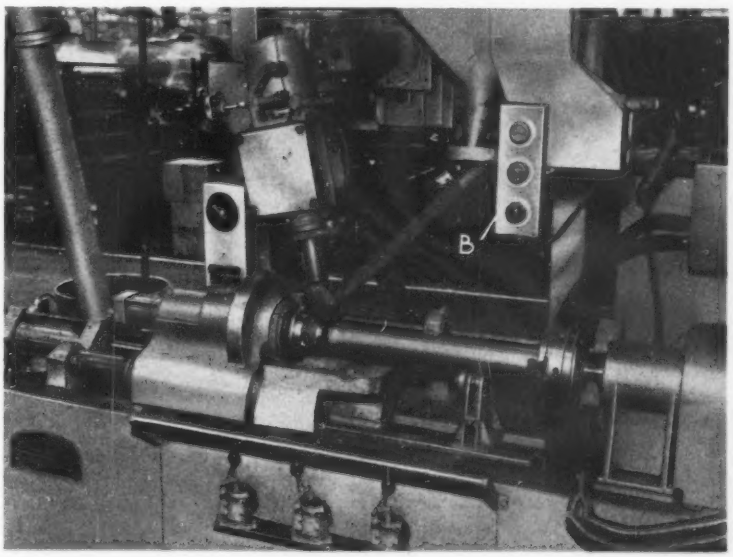


Fig. 2. Automatic welding of the flange to the axle tube is performed on this Bode automatic circumferential machine by the submerged arc method. The flux-return conveyor is seen in the general view in the heading illustration

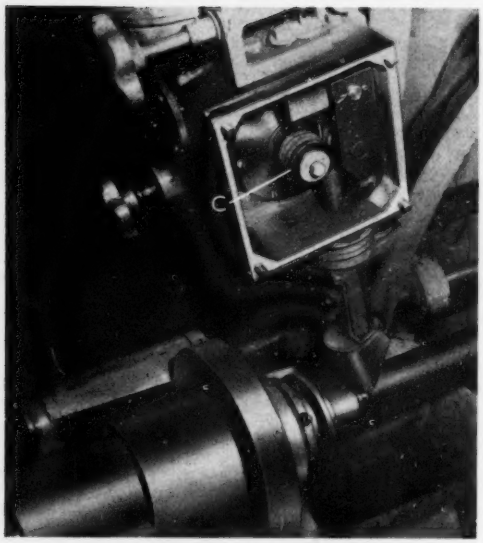


Fig. 3. Welding wire is fed from a coil to the weld area on the Bode machine by two grooved rollers

is carried in a fixed housing, and is equipped with an air-operated 3-jaw chuck, wherein the axle tube is gripped for the welding operation. Current is supplied to the right-hand spindle through carbon brushes, which are held in contact with it at a position just behind the chuck-mounting flange, and the tube is supported, during loading, by rollers on a bracket near the chuck.

With the flange engaged by the expanding chuck, and the sliding spindle housing in the extreme left-hand position, one of the air valves at the front of the machine is operated to clamp the flange. Under the control of another valve, the sliding housing is then advanced towards the right, up to a fixed stop, and at this point in the cycle the end of the tube is pushed into contact with the face of the 3-jaw chuck by the operator. The third air valve is then operated to close the chuck on the end of the tube, and with the flange and the tube in these fixed positions the overall length is within the dimensions specified. The automatic welding cycle of the machine is then initiated by depressing the button at the centre of the panel *B*, which serves to engage the drive to the left-hand spindle and start the feed of the $\frac{3}{32}$-in. diameter low carbon steel electrode wire, from an overhead reel.

At the same time, a flap controlling the flow of granular flux from a hopper above and to the right of the welding position is opened, and flux is delivered by a rubber hose into a funnel which surrounds the welding wire. This funnel is so arranged that the tube to be welded almost closes off the lower opening, and the molten area surrounding the wire is entirely covered with liquid or granular flux, a little of which escapes through the opening. The tube is rotated at a speed of one complete revolution in about 28 sec., and it is turned through a little more than 360 deg. to ensure that the ends of the weld overlap slightly. Flux which escapes from the funnel surrounding the weld area falls on to a screen, which is vibrated by a Syntron [Riley (I.C.) Products, Ltd.] unit. This screen retains large lumps, including pieces which solidify from the melted flux surrounding the weld area and crack off as the weld cools.

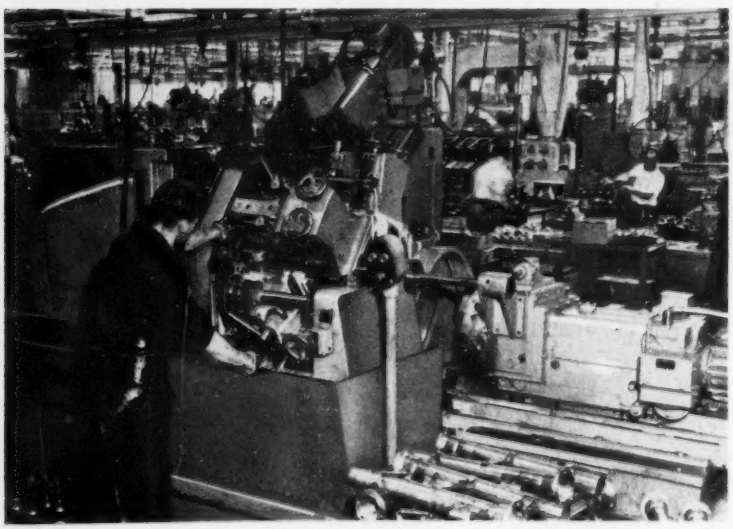


Fig. 4. After the spring seat and other brackets have been welded in position, the axle tubes are machined at each end on this special Archdale trunnion type machine

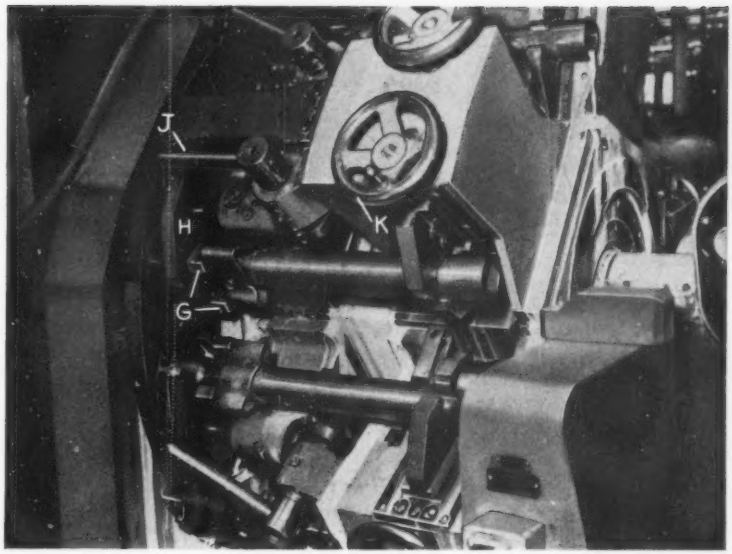


Fig. 5. Each fixture on the drum of the Archdale machine provides for clamping an axle tube of left- and right-hand. Angular positioning of the tubes is obtained from the faces of the spot-welded spring seats

Powder which passes through the screen falls into a hopper beneath, and is discharged by gravity into a tubular conveyor forming part of a continuous flux return system. This tube, which has an internal diameter of about 3 in., can be seen surrounding the machine in the general view given in the heading illustration, and it has large-radius bends at the points where it changes direction, also glass-covered inspection windows so that the movement of the flux can be easily observed. Within the tube there is a conveyor made up from a series of hemi-spherical cups, of a diameter approaching that of the tube, linked together at intervals of about 1 ft., to form a continuous chain. The large housing above the operator's head in the heading illustration contains the driving mechanism for the conveyor, comprising a 1-h.p. motor and an Opperman worm reduction gear.

The automatic cycle of the machine is controlled by a series of Burrell electric timers on a panel at the rear, which provide for variations in the periods during which the flux is allowed to flow, the rate of travel of the wire electrode, and the rotation of the work. Wire from the reel is fed to the weld area by means of grooved rollers enclosed in a box, which is seen with the cover removed in Fig. 3. The driving roller *C* is serrated, to grip the wire, and is driven by a motor of ¾ h.p., mounted on top of the box. Axle tube and flange assemblies, after being unloaded from this machine, are passed to a series of spot-welding machines nearby. Equipped with simple fixtures, these machines are employed, in succession, to weld spring seats, parking brake cable guides, and rear brake connector and equalizer brackets in position, the sides of the spring seats being subsequently welded manually, for extra strength.

ARCHDALE TRUNNION-TYPE BORING MACHINE

Both ends of the tube are next machined on a special-purpose Archdale 5-station trunnion-type machine, of which a general view is given in Fig. 4. This machine has a central fixture, designed to hold one tube of each hand at each of five stations, and a unit head is moved on horizontal ways at each side. At the first station, immediately in front of the operator, one right- and one left-hand axle tube are loaded into adjacent sides of two fixtures, and, when the fixture drum is indexed, these two components are carried downwards to the first machining station. The close-up view in Fig. 5 shows the method of locating and clamping the components. Similar arrangements are provided for left- and right-hand tubes and each part is first placed with the flanged end in a bushed hole in the face of the drum at the left, and is turned so that the spring seat can pass beneath double L-shaped brackets, as at *G*, which provide for angular location. Pressure is then applied to the rear face of the flange, to hold the opposite face in contact with pads in the bore of the bush, by means of a clamp *H*, which is moved sideways by the action of a cam turned by the lever *J*. Finally, serrated clamping jaws are applied to the right-hand end of the tube by turning the handwheel *K*, which moves both jaws inwards by equal amounts.

Operations carried out on the flanged ends of the two different tubes are identical, and at the

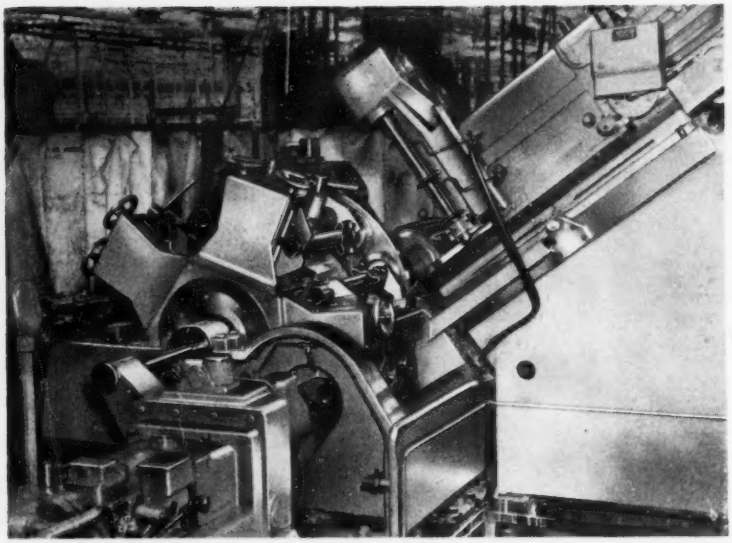


Fig. 6. A view of the Archdale trunnion-type machine showing the unit head with a slot-milling attachment, which is employed to cut slots in the flange faces. This head is mounted on inclined ways at the rear of the machine

first machining station the two bores *D* and *E*, Fig. 1, are rough-machined, and the bore *F* is finished and chamfered at the end. At the second machining station, the bores *D* and *E* are semi-finished, and the outer end is chamfered, all these operations being performed by spindles in the head at the left. In addition, at the second machining station, the end of the tube is faced and the bore is chamfered. A 0·09-in. deep by 0·18-in. wide groove is milled in the face of each flange at the third machining station, by a unit head mounted on inclined ways at the rear of the machine, as shown in the close-up view Fig. 6. Fitted to the mounting face of the unit head is a milling attachment with a single spindle carrying two Galtona (Richard Lloyd, Ltd.) 4-in. diameter slot-milling cutters of the required width.

Finally, the axle tubes are carried to the position at the top of the drum, where spindles in the left-hand head are employed to drill-ream the four 0·376/0·380-in. diameter holes in the flange, and this is followed by unloading at the position in front of the operator. After the diameter *L*, Fig. 1, at the unflanged end of the tube, has been plunge-ground on a Newall type L plain grinder, the flange face and tube end are machined, to give the required overall length, on a pair of Herbert

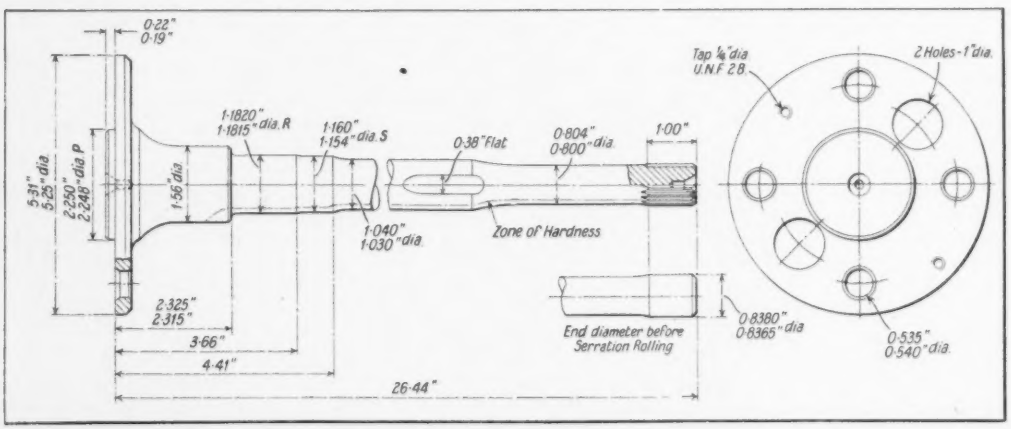


Fig. 7. The half-shaft for the Victor incorporates a forged flange and no separate hub is required. In preparation for rolling the spline serrations, the small end is machined to the diameter indicated on the smaller drawing

Smallpeice No. 6 machines. Subsequently, the diameters *D* and *E*, Fig. 1, are finished on a single-ended, 2-spindle, Ex-Cell-O fine-boring machine to the dimensions given, and concentric within 0·002 in. total indicator reading. Herbert Microbore tools are fitted to the bars employed on the Ex-Cell-O fine-boring machine. The tubes are then inspected before being passed to the appropriate point on the axle assembly line.

PRODUCTION OF AXLE-SHAFTS

In Fig. 7, the form and principal dimensions of the axle shaft or half-shaft are indicated, and it may here be noted that the shaft is of unusual design in that no separate hub is employed. Instead, each half-shaft has an integral forged flange at the outer end, which is machined and fitted with the wheel-mounting studs, as will be described. After being straightened on a 12-ton Hi-Ton hydraulic press, the shaft forgings, which are of alloy steel, are first faced on the small end, and centre-drilled at both ends, on a Hey No. 3 double-ended machine, in preparation for turning between centres. At a preliminary turning operation, two steady diameters are machined on a Maximatic lathe, and the main contours of the shaft are then produced on a battery of four Churchill-Redman 12 by 40 copy-turning lathes. A typical set-up on one of these machines is shown in Fig. 8, where the master shaft is clearly seen in the background, and the contours of the shaft which has just been completed may be observed.

The 0·8380/0·8365-in. diameter at the small end of the shaft is turned to size, and on the next four diameters grinding allowances only are left at this operation, which is performed at a spindle speed of 1,200 r.p.m. with a feed rate of 9 in. per min. Ardoloy (Alfred Herbert, Ltd.) tool-bits of triangular shape, with chipbreaker grooves, are employed, and the depth of cut taken on the rough forging varies up to about ⅝ in. Subsequently, the shafts are again straightened, where required, and the spline serrations on the small end are then rolled on a Michigan [Ex-Cell-O Corporation (Machine Tools), Ltd.] Roto-Flo machine. A close-up view of this machine is given in Fig. 9, and it may be seen that it is fitted with automatic loading equipment in the form of an indexing magazine.

Blocks with V-grooves in their upper faces are provided in the magazine to support and locate the shafts, which are placed in position manually, and these blocks are moved in succession to a position in line with the entry point between the rolling dies. Here, a hydraulic cylinder, housed within the casing on which the operator's hand is resting in Fig. 9, imparts movement to the carriage *M*, towards the dies. The carriage pushes the shaft, still supported in its V-blocks, forward, until the end is in contact with a stop on the end of another hydraulic cylinder on the opposite side of the dies. In this position, the dies are actuated by the pinion at the rear, which engages racks on the upper and lower die holders and moves them in opposite directions. The dies grip the end of the shaft, which is thus rotated on its axis, and the teeth are forced into the metal of the shaft, to form the splines.

When the dies have reached the limit of their travel, the hydraulic cylinder at the rear of the machine is operated to push the freshly-rolled shaft back to its original position, and the dies then return, ready for the next cycle. At this point the

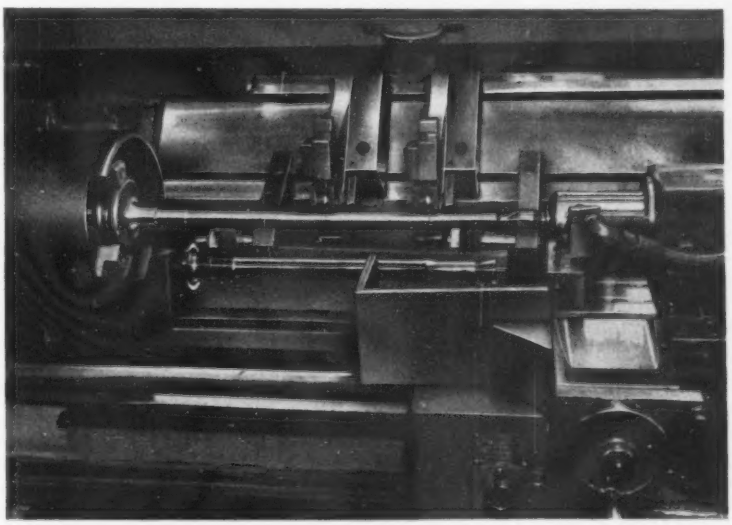


Fig. 8. After two steady diameters have been machined, the major portion of the axle shaft is profile-turned on one of four Churchill-Redman hydraulic copy-turning lathes with this set-up

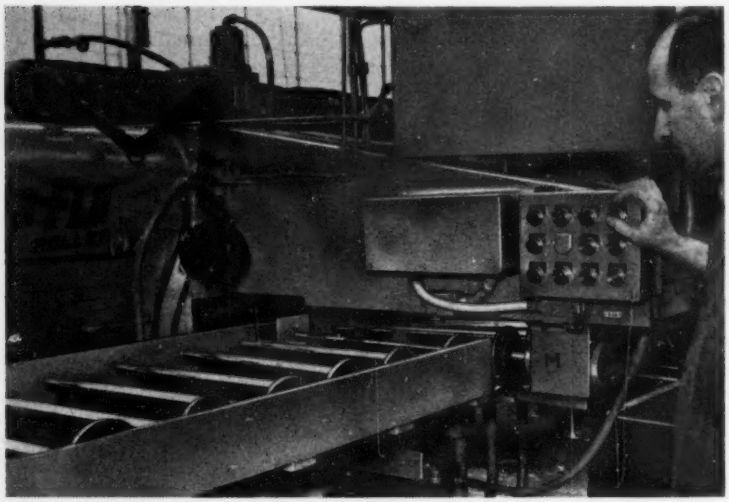


Fig. 9. Arranged for entirely automatic loading and unloading, this Michigan Roto-Flo machine rolls the spline serrations into the small end of the axle shaft in a cycle time of 7·2 sec.

conveyor is indexed, to carry the newly-rolled shaft clear of the dies, and, as the V-blocks dip to pass over the return pulleys of the conveyor, the shafts are automatically discharged on to felt-lined ways, from which they can be removed by the operator. The 20 involute serrations produced on the shaft at this operation have major and minor diameters of 0·857/0·861 and 0·7877/0·7917 in., a diametral pitch of 24/48, and a pressure angle of 45 deg. Some indication of the quality of the splines produced is afforded by the view in Fig. 10, which is reproduced almost full size, and shows the smooth surfaces on the flanks. The floor-to-floor time for the spline rolling operation is 7·2 sec. Dies for the operation are made from an alloy tool steel and have a life of approximately 200,000 components.

Both sides of the flange are next faced, and the outside diameter of the flange, and the 2¼-in. spigot diameter are turned, on a Maximinor lathe, and the outside of the flange is ground on a Precimax machine, with the work mounted between centres. A large Archdale rotary drilling and tapping machine is then employed for operations on the flange, the components being held in a vertical position with the flange uppermost. The machine is shown in Fig. 11, and it has a central drum which can be indexed about a vertical axis. On the eight sides of this drum there are fixtures, and in each fixture the lower end of the shaft is supported on a centre, and the upper end is held in a cam-operated stirrup-type clamp. The various stations provide for drilling, reaming and chamfering the four stud holes in the flange; drilling and core-drilling the two 1-in. diameter holes; and drilling and tapping two holes ¼-in. by 28 U.N.F. 2B.

A special machine of the company's own construction, seen in the foreground in Fig. 11, is next employed to chamfer the edges of the larger holes on the shaft side of the flange, and is tended by the operator of the drilling and tapping machine. Before the shafts are hardened, the major spline diameter is ground, to the limits indicated above, on a Newall LA machine, and a flat is ground at the necked portion for a later hardness check.

HIGH-FREQUENCY HARDENING

Automatic equipment supplied by the Electric Furnace Co., Ltd., is employed for surface-hardening the shafts over the distance indicated by the chain-dot line in Fig. 7. A view of the plant for the Victor half-shaft, which is one of three

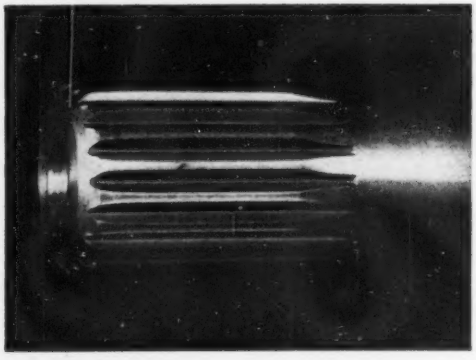


Fig. 10. A view of the spline serration produced on the Roto-Flo machine, showing the shape of the serrations and the high quality of surface finish that is obtained on the spline flanks

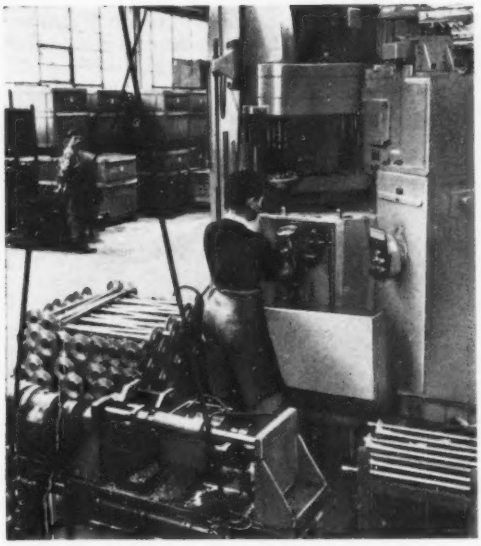


Fig. 11. After drilling, chamfering, reaming and tapping operations on the flange have been completed on the Archdale machine, the ends of the holes on the shaft side of the flange are chamfered on the special Vauxhall machine in the foreground

similar units installed in line for treating all the rear axle shafts produced in the works, is given in Fig. 12, and the sheet steel cabinet encloses a column with vertical ways on the front surface. A carriage, which moves on these ways, is counterbalanced by a weight within the column. Two sliding doors are provided at the front of the cabinet to prevent water loss by splashing, and these doors must be closed before the automatic cycle of the machine can be started.

A close-up view of the inside of the cabinet is given in Fig. 13, where the moving carriage is seen in its lowest position. At the bottom, this carriage has a horizontal platform from which two spindles project upwards. These spindles carry centres to engage the centre-holes in the half-shafts, also work drivers to engage the holes in the shaft flanges. During the hardening cycle, these spindles are driven at a speed of about 50 r.p.m. by a motor on the carriage, to equalize the heating effect of the high-frequency current. At the top of the carriage there is a bracket carrying two spring-loaded centres which engage the upper ends of the shafts, and these centres project downwards sufficiently to clear the lower faces of the spray-quench rings at *N*.

Above the quench ring for each shaft there is an inductor coil, and the distance between the inductor and the ring can be adjusted to provide for various soaking times depending on the depth to which the heat is required to penetrate from the surface into the shaft. The inductor is supplied with current at a frequency of 2,250 cycles per sec. from a motor generator of 200 kW. output. After the shafts have been loaded into the carriage centres, and the cabinet door closed, the start button is depressed, and the carriage is raised mechanically, at a speed of about 15 ft. per min., to the uppermost position. At the same time, the spindle driving motor is switched on, and

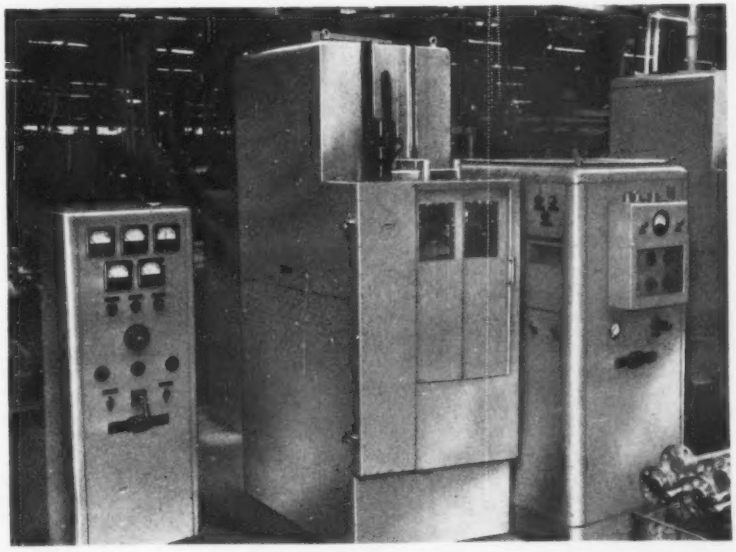


Fig. 12. The shafts are surface hardened over almost the full length on this automatic Efco high frequency induction heating unit

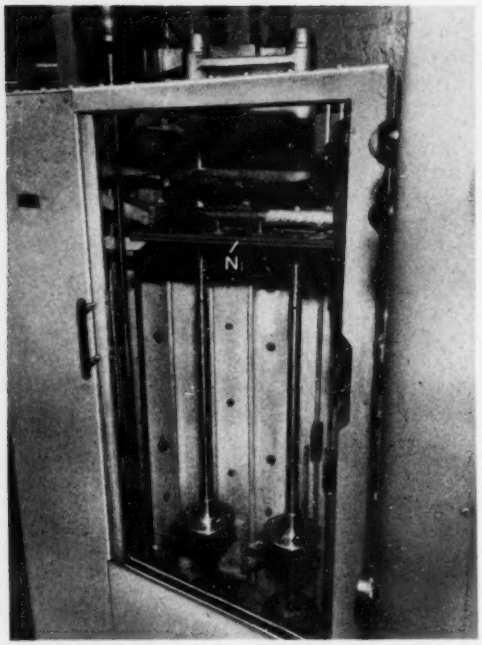


Fig. 13. In the cabinet of the Efco machine, two shafts are accommodated on a vertically-moving carriage which traverses them through the induction heating coils and spray quenching rings

when the carriage reaches the topmost position, the current supply to the inductor is connected.

A short dwell period suffices for heating the material at the flange end of the shafts, and the carriage then starts to move downwards, at a speed of the order of 18 in. per min., to carry the heated shaft through the quenching spray. To provide for variations in the diameter of the shaft, and consequently in the heating rate, the feed rate is changed, also the motor generator tapping. These changes are effected by means of adjustable stops on bars at the sides of the carriage, which operate micro-switches as they pass. At the end of the downward movement of the carriage, the current to the inductor and the water supply are cut off, and the doors can then be opened, and the components unloaded. The heating and quench are adjusted to give a minimum hardness value of 52 Rockwell C, which is reduced to 40 Rockwell C by a subsequent tempering operation.

For this tempering operation, Wild-Barfield pit-type furnaces are employed, with forced air circulation for heating the charge. The shafts are loaded into holders, in which they are suspended by the flange ends, and do not touch each other. Each holder accommodates about 60 shafts, and is lifted by an overhead crane and lowered into the furnace where the shafts are held at a temperature of 325 deg. C. for a period of 2 hours. When this time has elapsed, the holder is lifted from the furnace and immediately lowered into a quenching tank containing cold water. The shafts are then removed and transferred to a special Spenstead Centriblast shot-peening machine.

SPECIAL SPENSTEAD SHOT-PEENING MACHINE

A general view of the shot-peening unit is given in Fig. 14, and it has a circular table which is driven continuously at a speed of about 1 rev. in 4 min. Near the periphery of the table there is a vertical fence with a series of 40 holes through which the shafts are loaded. Another, smaller, fence, near the table centre, has 40 V-shaped notches in its upper edge in which the serrated ends of the shafts are placed for location purposes. The shafts are thus supported horizontally, and as the table rotates, they are carried in turn

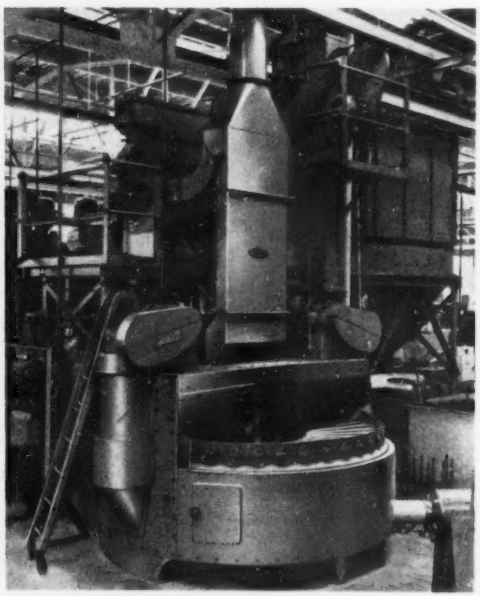


Fig. 14. The half-shafts are shot-peened in a special Spenstead Centriblast unit, with a circular table which carries them through the blast from two centrifugal projectors

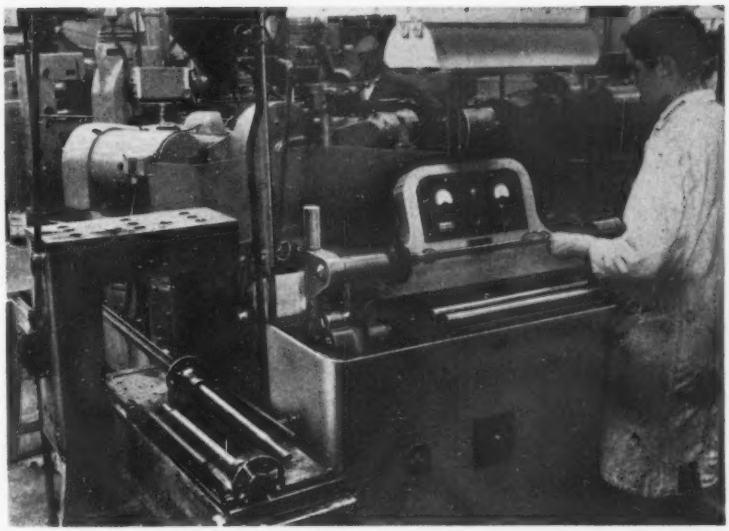


Fig. 15. After inspection for cracks on this Fel-Electric machine, the shafts are placed on the carriage at the left and passed through a demagnetizing coil

through the blast from two centrifugal projectors, each driven by a motor of 15 h.p. No. 40 shot is employed, and after leaving the work it falls through holes in the table on to a flat collector surface in the machine base.

Here, the shot is swept up by rubber blades, rotating with the table, and is raised by a bucket elevator to the main hopper above the machine. Both the hopper and the machine are connected to a large capacity dust collector, seen in the background in Fig. 14 to prevent escape of dust into the shop atmosphere. As the table rotates, the shafts are turned through about 120 deg. by the operator, and the peening action, which is intended to prevent fatigue failures by introducing residual compressive stresses in the surface layers, is thus distributed evenly over the hardened surfaces. Next, the flat which was ground near the small end of the shaft is lightly polished on a bob, and a hardness test is then carried out at this position, on a Reicherter Briviscop (Lerche Machine Tools, Ltd.) semi-automatic machine.

After the shafts have again been straightened, if necessary, they are passed to a Precimax grinder, on which the spindle head is set at an angle, for grinding the flat face of the flange, also the diameter *P*, Fig. 7, of the register. Another Precimax type MPH 10/36 machine is then employed to finish grind the bearing portion *R*, and semi-finish the oil seal diameter S, Fig. 7. The oil seal surface is finished on a similar machine, to the limits given, and a soft rubber ring is fitted to protect the two finished surfaces. Finally, the completed shafts are tested for cracks on a slightly modified Fel-Electric magnetic machine.

On this machine, which is shown in Fig. 15, the shaft is mounted between centres, and is first connected to a 15-amp. current source to produce a magnetic field while the fluid containing the detecting ink is allowed to flow over the surface. At this stage, and during subsequent inspection, the shaft is turned by means of an air cylinder-operated mechanism so that the fluid spreads over the entire surface. A stronger current is then passed through the shaft, and has the effect of opening any cracks which are present so that the fluid can penetrate more effectively. A very careful inspection is then made, with the aid of the double fluorescent light unit above the machine. The shafts are then placed on the small wheeled carriage at the side of the machine, and when four have accumulated, the carriage is pushed by the operator through the coil wound on the rectangular former surrounding the track. This coil is connected to an A.C. supply and serves to demagnetize the shafts. When the ink has been washed off the shafts in a paraffin bath, they are again inspected before being passed to the assembly lines, which will be discussed in a further article.

GAS TURBINE ENGINE FOR A VEHICLE.—The Research and Engineering Centre of Ford Motor Co., Dearborn, Michigan, U.S.A., announce that they have developed an experimental gas turbine engine which has been undergoing exhaustive tests for the past 18 months. Intended for use in road vehicles, the engine develops 160 h.p. As a result of certain developments, the company has effected considerable reductions in the cost of producing turbine wheels. In addition, a new type of heat exchanger has been designed and built, which, it is stated, should reduce the fuel consumption.

I.C.I. Automatic Austempering Plant for Imperial Typewriter Components

Very efficient hardening and tempering, on a quantity production basis, of a variety of pressed, high-carbon steel, components for typewriters is carried out at the Leicester works of the Imperial Typewriter Co., Ltd., by the use of an automatic salt-bath austempering plant, built and installed by Imperial Chemical Industries, Ltd., which has been in successful operation for some years. More recently an I.C.I. plant of almost identical design has been installed in the company's factory at Hull, where Imperial portable typewriters are manufactured. Typical components which are being handled are illustrated in Fig. 1.

A view from the front, at the loading end of the plant at the Leicester works is given in Fig. 2, and Fig. 3 is a rear view, with the unloading end on the right. The general layout of the plant is shown diagrammatically in Fig. 4. This drawing relates to the installation at Hull, which has a slightly different conveyor chain arrangement from that seen in Fig. 4. A view inside the plant, looking along the conveyor from the loading end, is given in Fig. 5.

An important requirement for the typewriter parts concerned—and this applies particularly to the type bars *A*, Fig. 1—is that they should have a hardness of 49 to 51 Rockwell C, and yet be sufficiently tough to withstand the shocks encountered in service. This condition is ensured by the austempering process, which produces a close-grained bainite structure in the metal, and not a martensite structure. It is also essential that no distortion should occur during hardening, since the type bars are finish formed before heat treatment to specified angles on the ends *X*, which carry the type. For this reason, special precautions are taken in the handling of the workpieces. All the parts shown in Fig. 1 are of En.42F steel, which contains 0·75 per cent carbon, 0·35 silicon, 0·6 to 0·9 manganese, 0·05 (max.) sulphur, and 0·05 (max.) phosphorus.

The sequence of operations in the plant comprises: (1) pre-heating the work in air; (2) salt-bath hardening; (3) salt-bath tempering; (4) quenching in cold water; (5) washing in soda solution, and (6) drying in hot air.

LOADING ARRANGEMENTS

The workpieces are carried through the various stages in trays, as seen at *A* in Fig. 5, also in Fig. 6, which is a view through a side access panel at one of the transfer stations. Each tray is suspended by side arms from a round cross bar provided with flat bearing plates *B*, which rest on the links of the conveyor chain, between the rollers, so that the complete unit is removable. Trays are of fabricated welded construction, with perforated bottom plates to provide for drainage, and experience has shown that mild steel is the most satisfactory material since it is inexpensive, has a considerable life, and can easily be straightened when distortion occurs. Fairly thin-gauge sheet is em-

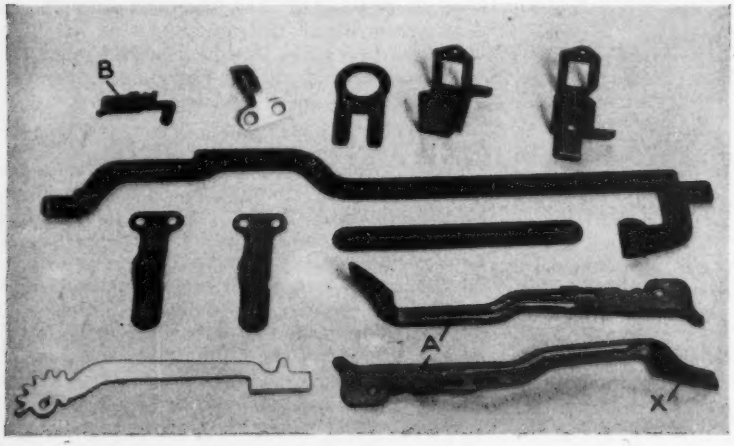


Fig. 1. Typical high-carbon steel parts for Imperial typewriters which are hardened and tempered in an I.C.I. automatic austempering plant

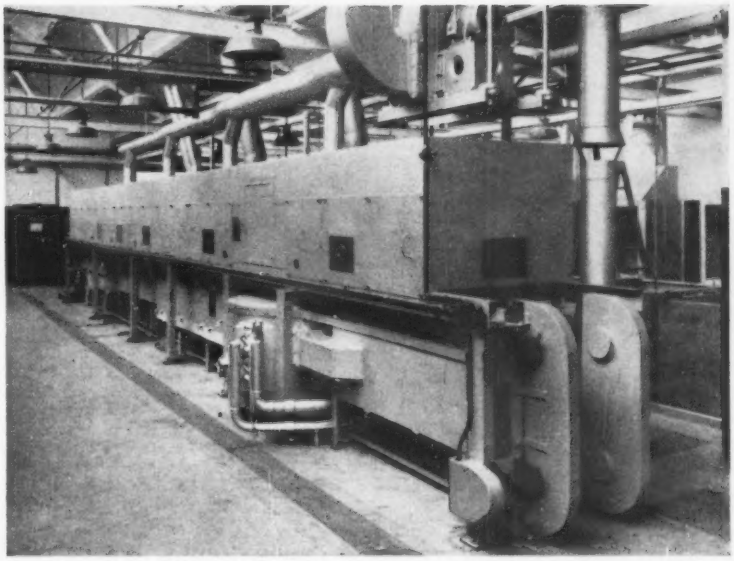


Fig. 2. View from the front at the loading end of the I.C.I. conveyorized austempering plant

ployed for the trays, to permit the required rapid heating of the work in the salt bath.

Small components, such as the tabulator stop plate *B*, Fig. 1, are loaded at random in a thin layer on the tray bottom, as seen in Fig. 5, but type bars and other long parts, which are liable to distortion during heat treatment, are placed individually in a vertical position, in special holders. For this purpose, the tray units from the delivery end of the furnace are transported in batches, on rack trolleys, to an adjacent loading room, where, under cooler working conditions, the parts to be heat treated are placed in the holders by two girls. When the smaller components, which do not require holders, are being processed, the empty trays are placed on the conveyor, in turn, by the furnace operator, who then loads the work directly from a bulk container conveniently located between the runs of the conveyor chain.

Referring to the lay-out drawing, Fig. 4, the conveyor indexes the tray units through an air preheated zone *C*, heated by waste flue gases from the adjacent gas-fired salt bath furnace *D*, which, it may be noted, is mounted on wheels and can be withdrawn transversely along rails to facilitate servicing. Transfer of the tray units from the pre-heating zone to the hardening bath *D*, and through the subsequent stages, is effected by swinging arms *E*, also seen in Fig. 5 and 6. These arms are fitted at the ends with cross pins, which engage ears *F* on the tray cross bars. The shafts carrying the swinging arms are driven by bevel gears from a longitudinal shaft at the rear, which

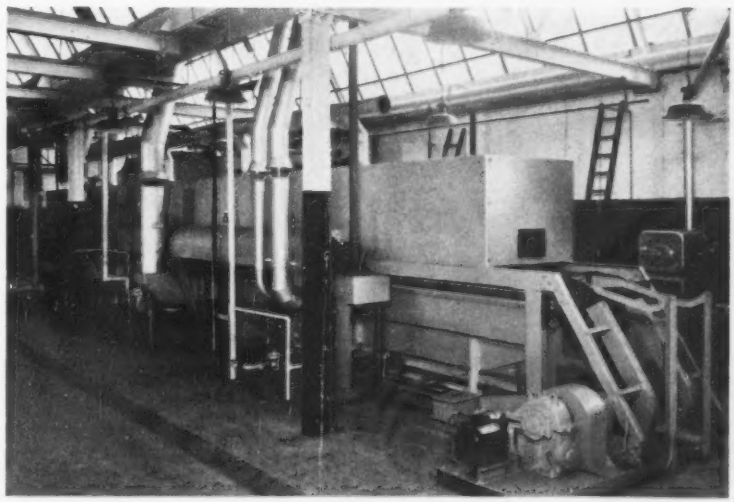


Fig. 3. Rear view of the I.C.I. austempering plant, with the unloading end on the right

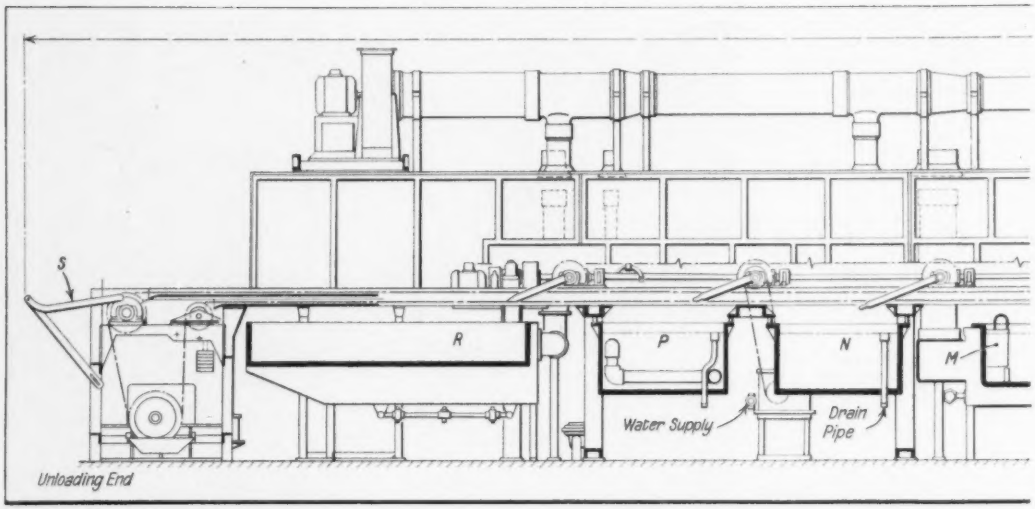


Fig. 4. Sectional elevation of the austempering plant, showing the layout of the various stages

is coupled to a motor-driven reduction gearbox, and the backward and forward swinging motion is obtained by reversal of the driving motor under the control of limit switches.

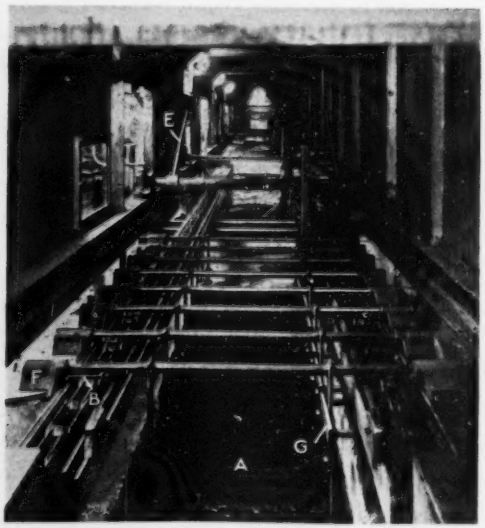
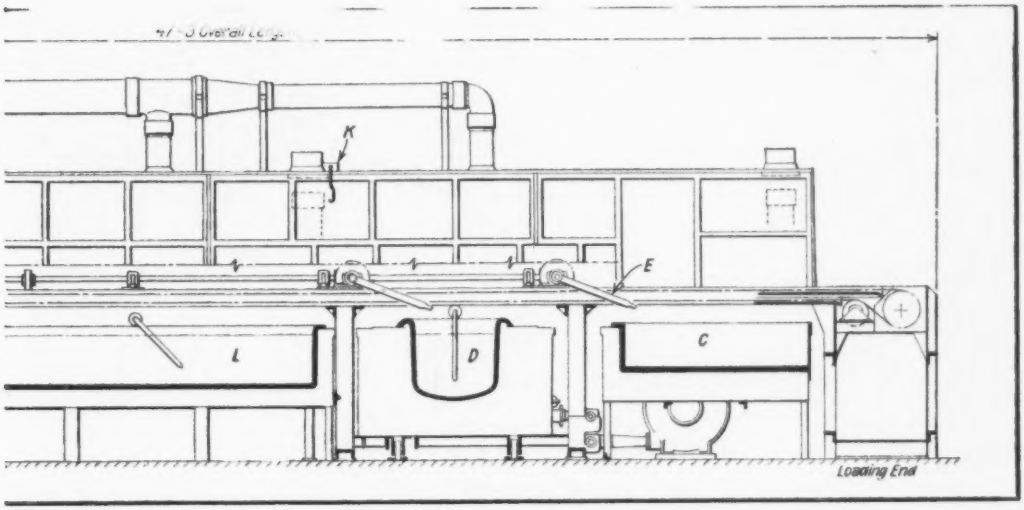


Fig. 5. A view inside the plant, looking along the conveyor from the loading end

Tray units are loaded by the operator on to alternate chain links, but the chain is indexed in increments of one pitch. After a tray has been picked up and deposited on the conveyor for the next stage, the chain is indexed forward one pitch, so that the ears *F*, Fig. 5, are clear of the cross pins in the transfer arms. The latter then swing back, and the conveyor is again indexed one pitch to bring the next tray to the pick-up position, in readiness for transfer. To prevent the work tray from swinging as it is being transferred, two projecting pins are provided on the cross bar *G*, which engage fixed guide plates as at *H* and *J*, in Fig. 6, at each stage. The cross bar and pins can also be seen clearly in Fig. 5. The transfer arms are allowed to dwell for a few seconds at the top of the stroke, to allow accumulated salt to drain from the perforated work tray back into the hardening bath, and carry-over is thus reduced. A safety switch, operated by a hook arrangement, is provided at *K*, Fig. 4, to prevent the inadvertent return of a tray from the quenching to the hardening bath.

Pre-heating to a temperature of 250 to 300 deg. C. occupies 13 min., and the work remains for 3 min. in the hardening bath, which is held at a temperature of 815 deg. C. and comprises 45 per cent potassium chloride and 55 per cent sodium carbonate. The nickel-chromium alloy furnace pot holds about 4 cwt. of salt.

The tempering bath *L* is also gas fired, and contains 40 per cent potassium nitrate and 60 per cent sodium nitrite, which is held at a temperature of 310 deg. C. The bath is approximately 9 ft. long,



and each work tray is allowed to remain in the salt for 20 min., to obtain the required bainite grain structure. A mechanically-driven paddle keeps the salt in continuous agitation to facilitate temperature control, and a fine-mesh separator basket *M* collects any salt carried over from the hardening bath *D*. It is important that this salt should be removed periodically since it tends to raise the temperature of the tempering bath and causes thickening of the solution. Separation is accomplished by the action of an air jet which causes the heavier carry-over salt to be delivered into the basket, and the latter is usually removed and emptied every 2½ hours. The waste salt is discarded, and about 100 lb. of new salt per day is added to the tempering bath, and 70 lb. to the hardening bath.

In the quenching tank *N*, the water is circulated by a pump, and each tray remains in this tank for 3 min., and is then transferred to the washing tank *P*, which is maintained at a temperature of approximately 110 deg C. by gas heating. The washing time is 6 min. and the trays are next advanced to the gas-fired hot-air drying zone *R*, which is approximately 7 ft. long and provides for drying, at a temperature of about 110 deg. C., for a period of 23 min. As the conveyor chain indexes forward, the trays of finished work are delivered, in turn, on to a ramp at *S*, to await removal by the operator. A work tray thus passes through the installation in 68 min., and a tray is delivered on to the ramp every 1½ min. The time-temperature diagram for the cycle of operations is given in Fig. 7. A Kent recording temperature controller is installed for the hardening salt bath, and a Cambridge controller for the tempering bath.

Drive to the conveyor chain is provided by a

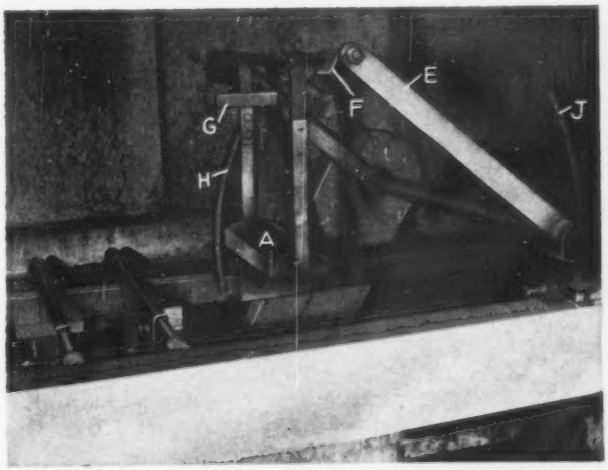


Fig. 6. One of the work tray transfer stations seen through a side access panel

motor and gearbox unit located at the delivery end, and the indexing movements are controlled by limit switches in conjunction with a process timer. In connection with the transfer arm drive, it may be noted that the last three arms of the system operate in the reverse direction to the first two arms, the object of this arrangement being to reduce the load to be lifted at each cycle. As may be seen in Fig. 2, the installation is entirely enclosed and hot gases and fumes are removed by a fan unit and overhead ducting.

The furnace is normally maintained in operation for about 30 hours per week, and some 200,000 components of different types are treated. When hardening and tempering type bars, an output of 10,000 pieces per hour is obtained, and only one male operator is required on the furnace, with two girls loading the work trays.

ANNEALING THE ENDS OF TYPE BARS

The ends *X*, of the type bars *A*, Fig. 1, to which the type is subsequently soldered, require to be annealed after the hardening and tempering operation. For this purpose, a Radyne 6-kW induction heating installation, set up as shown in Fig. 8, is used, which enables the parts to be handled at the rate of 2,000 per hour.

A work-holding disc *A* of Sindanyo heat-resisting material is mounted on the output shaft of a small geared motor, whereby it is rotated continuously at a speed of 1 r.p.m. Forty slots are provided in the disc, into which the type bars are loaded by hand, as seen at *B*, and after passing through the heating coil *C* the pieces fall, by gravity, out

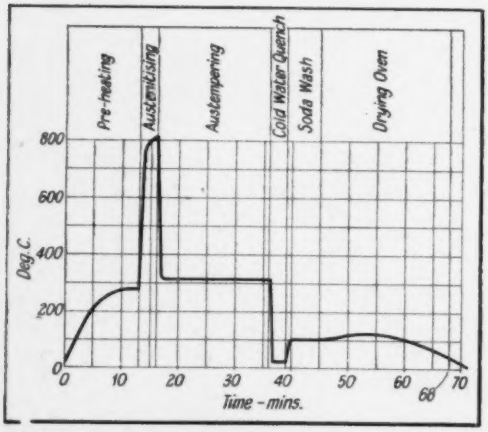


Fig. 7. Time-temperature graph for the sequence of operations in the austempering plant

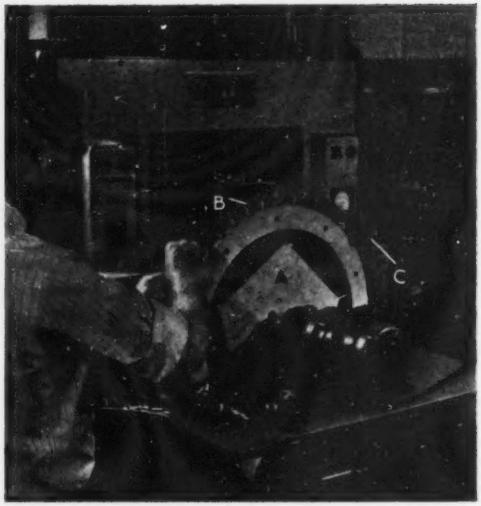


Fig. 8. Set-up on a Radyne induction heating unit for annealing the ends of type bars after the austempering operation

of the locating slots into an adjacent container.

Type bars are handled in batches according to the angle—either right- or left-hand—to which the end is bent, and there are 23 different angles in a set of type bars for the Imperial standard typewriter. Three different heating coils are employed to cover this range of work, and there is also provision for adjusting the coils for angle.

This Radyne high-frequency heating equipment is employed for a variety of other workpieces, and the motor-driven work carrier shown in Fig. 8 is mounted on a table so as to form a separate unit, which can readily be placed in position after the normal work table and quenching tray of the equipment have been removed.

LARGE POLYTHENE CONTAINERS—Tool Treatments (Chemicals), Ltd., Colliery Road, Birmingham Road, West Bromwich, inform us that, in conjunction with a German company, they have introduced a new process in this country for the production of polythene goods of large sizes, including containers up to 50 gal. capacity. These containers can be supplied with lids or wire handles, and in forms suitable for stacking. They are made by the Engel process which, it is stated, enables tooling costs to be greatly reduced, so that quite short runs are economical.

Production Jig Boring

Some Applications at the Works of the Newall Engineering Co., Ltd.

Attention has already been drawn, in various articles in MACHINERY, to the increasing tendency to employ jig boring machines for batch production, in addition to high-precision jig and tool work. Although the practice of employing jig borers as production machines is now well established, however, their potentialities in this field are not yet, perhaps, sufficiently widely appreciated. Various examples of such applications at the works of the Newall Engineering Co., Ltd., Old Fletton, Peterborough, will here be considered. A line of nine Newall machines, as shown in Fig. 1, has been installed for the batch production of a diversity of machine tool components, and this line, it may be noted, has grown to its present size over a period of approximately 2½ years, from a single machine principally employed for demonstration purposes.

An early appreciation of the above-mentioned trend, coupled with extensive practical experience in their own factory, led the Newall Company, some time ago, to redesign their range of jig borers. As a result, the latest types combine the high standard of accuracy required for tool-room work, with suitability for relatively heavy duties, and the ability to maintain this accuracy over long periods under production conditions. The machines are of open-sided single-column construction, which facilitates loading and access, and enables large components, in excess of the normal table capacity, to be accommodated. Particular attention has been devoted to the spindle design, to ensure axial stability, so that the machines can be employed for stock-removal at economic rates and for such duties as shave-milling, for producing accurate flat surfaces. In appropriate instances, moreover, power feed has been provided for the table and cross-slide motions, to cater for various milling and surfacing operations.

In Fig. 1, the machine in the foreground is of the type 2442, which has a table measuring 24 in. by 42 in. The spindle speeds are steplessly variable from zero to 2,000 r.p.m., and there are eight upward and downward feeds of 0·0005 in. to 0·012 in. per rev., also steplessly-variable hydraulic milling feeds. All the other machines in the line are of the 2436 type, with the optional milling feeds, which are steplessly variable from ¾ in. to 15 in. per min. On the 2436 machine, the milling feeds are provided by 1-h.p. geared D.C. motors, which are supplied from a static A.C./D.C. converter, with automatic regulation to maintain constant speed under varying load. The table, which measures 24 in. by 36 in., has a lateral travel

Fig. 1. The Newall production jig boring line, here shown, comprises one type 2442 machine, and eight type 2436 machines

of 24 in., and a cross travel of 18 in. Rapid power traverse is also provided for both motions, and is controlled by push-buttons. The spindle speeds are steplessly variable from zero to 2,500 r.p.m., and there are four upward and downward feeds of 0·002 in. to 0·008 in. per rev.

As already indicated, the work undertaken is of a varied nature, and, generally, the batch-quantities are small. A proportion of prototype components is handled, and, occasionally, the machines are also employed on jigs or fixtures. Despite the fact that they are in operation for an appreciable proportion of each working day, and that several have been in service for a considerable time, there is little evidence of deterioration, and the machines continue to afford a standard of accuracy adequate for tool-room work. It will be noted from Fig. 1, moreover, that they operate under normal production conditions, in an open shop.

Typical operations for which the machines are employed, in addition to boring, include milling, shave-milling, facing and back-counterboring. For the latter purpose, use is made of the standard upward feed of the quill. The "turning" of external diameters of spigots and bosses is performed with the aid of fly-type tools, and the machines are also used for drilling, when accurate hole-spacing is required. In this connection, it may be noted that drilled holes range from $\frac{1}{32}$ in. diameter, on a 1-in. diameter pitch circle, to 1 in. diameter and over, on pitch circles up to 40 in. diameter. Bored holes range from $\frac{1}{16}$ in. to 12 in. diameter. Some of the components machined are large, and on the type 2436 machines, items weighing up to 18 cwt. have been accommodated satisfactorily.

In practice, the fact that the shop is not temperature controlled has not been found to cause any particular difficulty in maintaining close tolerances, and the only precaution taken is to stack the components on the shop floor, next to the machines, so that they are at approximately the same temperature. On ferrous materials, limits of the order of ±0·0001 in. can be maintained, with reasonable care, and on aluminium alloys, hole-centres can be held within ±0·0005 in., and bore-diameters to Newall A limits.

ECONOMICS AND MACHINE-UTILIZATION

Before proceeding to a detailed description of some of the set-ups employed, some reference will be made to the economic aspects of the firm's production jig boring policy. It is stated that, by using jig borers as production machines, it has been possible to effect considerable savings. Since much of the work is concerned with small batches, a large number of jigs and fixtures would be required for production by the more usual methods. By using jig borers, these items are eliminated, and component design can readily be changed. In many instances, moreover, handling and setting-up times are reduced.

On one typical component—a 15½-in. long aluminium-alloy gearbox—it is necessary to maintain the centres of the two main bores within 0·0005 in. In each end of the component, there is a series of attachment holes, all of which must be accurately related to each other, and to the two main bores. The various holes must be bored or drilled from opposite ends, and a set of 5 jigs, of an estimated total cost of approximately £1,000, would normally be required for these operations.

It was decided to machine all the holes on the jig borer, and the first batch of six components was completed in 15 hours each. The time required to set the machine and drill each attachment hole was 1½ min., whereas on a radial drill, the corresponding time would have been 1 min. In this instance, the saving in time that would have been possible with conventional machining was insufficient to justify the cost of jigs. When the series of operations is carried out on the jig-borer, moreover, there is less risk of damaging previously machined surfaces on the aluminium castings.

Important savings can also be obtained by shave milling and dovetail milling, as an alternative to hand scraping and fitting. On one typical component, hand scraping originally occupied 44 hours, after a conventional milling operation taking 11 hours, whereas milling and shave milling, to the required accuracy, on a jig boring machine, are now completed in 15 hours. A high degree of accuracy is also obtained by means of the dovetail milling technique employed, which will later be described. Shave milling is performed by taking light cuts with a fly-type tool, or a special Galtona inserted carbide tooth face-milling cutter, depending on the nature of the work. Fly-type cutters are employed mainly for large surfaces, the softer materials, such as aluminium, and non-rigid components. Face-milling cutters are applied principally to smaller surfaces on harder materials such as cast iron and mild steel, and rigid parts.

By employing either of these methods, surface finishes of exceptionally high quality can be obtained on aluminium. On cast iron, a 4½ in. diameter face-milling cutter of the type mentioned, run at 240 r.p.m., with a feed of 3 in. per min., will normally give a surface finish within 14 micro-inches, C.L.A., and with special care, even better finishes can be provided if necessary. In connection with the use of fly-type cutters, it may be mentioned that the company has success-

fully machined aerofoil sections in the Nimonic alloys by tangential plane milling, to a surface finish of 20 micro-inches, C.L.A.

If jig borers are to be used economically for production work, effective machine utilization is of great importance. Some years ago, as part of an investigation in this field, a time recorder was fitted to a jig borer in the company's factory, in order to determine for what proportion of the working day the spindle was performing useful work, and the figure obtained was only 7 per cent. Further investigation showed that much of the idle time was attributable to the fact that the operator was required to extract dimensional information from drawings, and perform various calculations, for example, to obtain the ordinates for a series of holes on a pitch-circle. The investigation also emphasized the importance of relieving the operator of other incidental duties, such as grinding special cutters, and of providing an adequate range of tools at the machine.

PRE-PRODUCTION PLANNING

It was apparent that some form of rationalization was required, and a system of pre-production planning was instituted. Development of this system was continued concurrently with the growth of the jig borer line over the 2½-year period earlier mentioned, and as a result, a machine-utilization figure of 38-40 per cent has been achieved. This improvement is particularly significant when it is considered that, with a conservative estimate of overhead costs, there is a loss of at least 20s. for each hour that a jig borer stands idle. It indicates, moreover, that the engagement of a planning engineer for work hitherto regarded as part of the machine-operator's duties is fully justified.

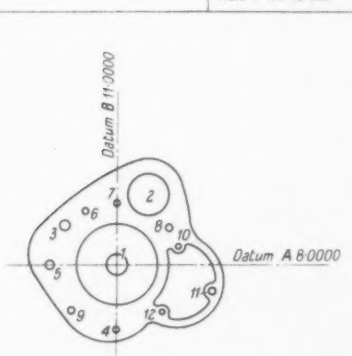
Under the present system, all necessary dimensional information and a full set of tools are prepared in advance, and are issued to the operator with each job. The information is presented in tabular form on a planning layout sheet of the type shown in Fig. 2, which gives full details for each stage. As may be observed, setting instructions and datum figures are provided for initially locating the work on the table, and the various holes, bores, and other features are listed, in the order of machining. Ordinates for each stage are given in two adjacent columns, and where appropriate, the settings for an O.M.T. rotary inclinable table are also indicated. The tools required are listed against each stage and, in some instances, speeds and feeds are also shown.

To keep to a minimum the time spent in selecting and changing the various tools, they are placed in hangers of the type shown in Fig. 3, which are provided at the various machines. Each hanger

Setting Instructions

Centralise over 6.500 bore and square up to marking out. After skimming large Joint Face (Op.1.).

Hole 1 1A 1B etc.



Setting	Datum Face and Hole	Hole No.	Micrometer Reading Front	Micrometer Reading Side	Circular Table Reading Rotary	Circular Table Reading Incline	Tool	Dimension and Limit	Depth From Datum or Face	Method
2	1 & B	1	8.7000	11.0000	-	-	Rough with EDS 1B-4 with 1B-15	3.000 bore	Thro' web	
			" "	" "	-	-	Finish with EDS 6-7	" "	" "	
		2	12.3300	8.9000	-	-	Rough as 1	3.0000 bore	Thro' to slot	
					-	-	Finish as 1	"	"	
					-	-	O.M.T. Head and Special Tool	Circlip Grooves		
					-	-	O.M.T. Head and Standard Tool	Relieve		
		3	9.875	14.9175	-	-	⅛" - 1/64" drill	0.500A Bore		
					-	-	O.M.T. Head & Std. Tool	"		
		4	3.4375	11.0000	-	-	3/8"Drill	3/8" Hole	Thro'	
		5	8.0000	15.5625	-	-	" "	" "	"	
		6	11.2262	14.2262	-	-	" "	" "	"	
		7	12.5625	11.0000	-	-	" "	" "	"	
		8	10.2812	7.0488	-	-	" "	" "	"	
		9	4.2636	13.2557	-	-	" "	" "	"	
		10	7.9269	6.4394	-	-	'F' dia. Drill	5/16" whit.	1.1/4"	
					-	-	5/16" whit. tap	" "	1"	
		11	4.3965	8.2040	-	-	'F' dia. Drill	" "	1.1/4"	
					-	-	5/16" whit. tap	" "	1"	
		12	4.8592	4.7162	-	-	'F' dia. drill	" "	1.1/4"	
					-	-	5/16" whit. tap	" "	1"	

Fig. 2. Typical pre-production planning layout sheet, showing the comprehensive dimensional information provided for the operator, to avoid the need for calculations

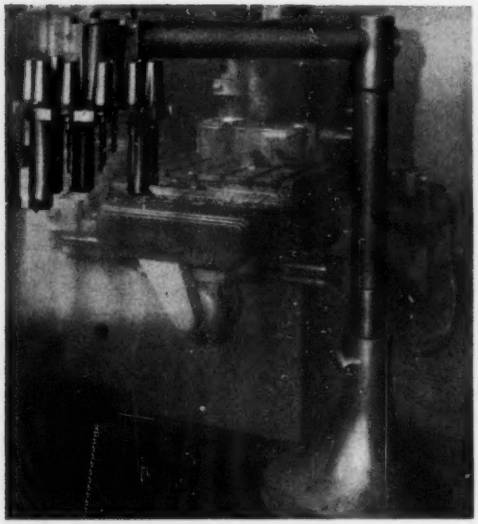


Fig. 3. Pivoted hangers, of the type shown, minimize tool-handling, and facilitate efficient machine utilization

Fig. 4. This type of tool cabinet, with pivoted trays to permit rapid selection, has also been designed as an aid to machine utilization

comprises a tubular column and arm, which are arranged to pivot on a cast floor-pedestal, and a radially-slotted circular plate is carried at the outer end of the arm. Recesses machined in the upper face of the plate serve to locate the tools by the flanges, as seen, and the arm may be swung into any convenient position. The plate can be turned, for selection of individual tools, and to facilitate mounting and removal, the slots may be aligned directly below the spindle nose. On these machines, it may be noted, the spindle nose design is such that tools can be changed in a few seconds. Storage of the tools in this manner also reduces risk of damage.

A further aid to efficient utilization of the machines, recently introduced by the company, is the cabinet shown in

Fig. 5. Typical "wide"-tolerance component, machined economically by jig boring methods

Fig. 4, which is designed for the storage of a comprehensive range of tools and equipment, in an orderly manner. The trays are pivoted, each by one corner, to alternate sides of the cabinet, so that they can be swung outwards to right and left. Each tray is fitted with a flock-covered wood lining, which incorporates nest-type locating blocks, and is designed to accommodate a specific group of items.

"WIDE" TOLERANCE WORK

Economic machining on jig borers is not confined to close tolerance work, and on some components with relatively wide tolerances, the use of such a machine can show appreciable time savings, as compared with more normal methods. Since procedures associated with work of high accuracy can usually be relaxed, and the wider tolerances maintained with ease, the whole machining programme is simplified. The savings in time are attributable to the facilities for co-ordinate table setting, and to the fact that information is readily obtainable from the planning layout sheets. Moreover, boring bars and similar tools must often be prepared specially for machining by orthodox methods, whereas such items are part of the standard jig borer equipment.

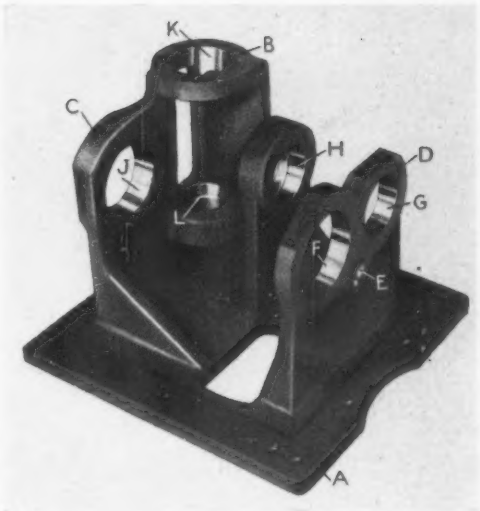


Fig. 7. Gearbox component, in cast iron, machined by jig boring methods, in a combined time of 93·3 min.

Fig. 6. Holes, initially flame-cut to 4¾ in. diameter, are jig bored to 5⅛ diameter, as shown. Pitch-circle diameter, spacing, and concentricity are readily maintained

An example of wide tolerance work is afforded by the component shown in Fig. 5, in which the large, equally-spaced holes near the periphery are initially flame-cut to 4¾ in. diameter, and subsequently finish bored in two stages, to 5⅛ in. diameter, at the set-up shown in Fig. 6. General tolerances of the order of ±0·005 in. are stipulated, and the spacing, pitch-circle diameter, and concentricity with the central bore are readily maintained on the jig borer, without any special care.

For the first operation on the flame-cut holes, a standard roughing bar is employed, in which the carbide-tipped double-edged tool is pre-set to $\frac{1}{32}$ in. below the finished size. This bar is run at 400 r.p.m., and removes approximately 0·34 in. from the diameter at a feed of 0·004 in. per rev. Bars of this type, it may be noted, are usually employed for machining bores exceeding the diameter of the largest drill supplied with the machine. On cast iron, cuts ranging up to $\frac{1}{4}$ in. deep are commonly taken with a feed of 0·004 in. per rev. at a surface speed of 200 ft. per min. For the finishing cut, a boring bar with a Herbert Microbore tool is employed, which is also run at 400 r.p.m. At this stage, the feed is 0·002 in. per rev.

As may be observed from Fig. 5, the holes are also counterbored, and three recesses are machined

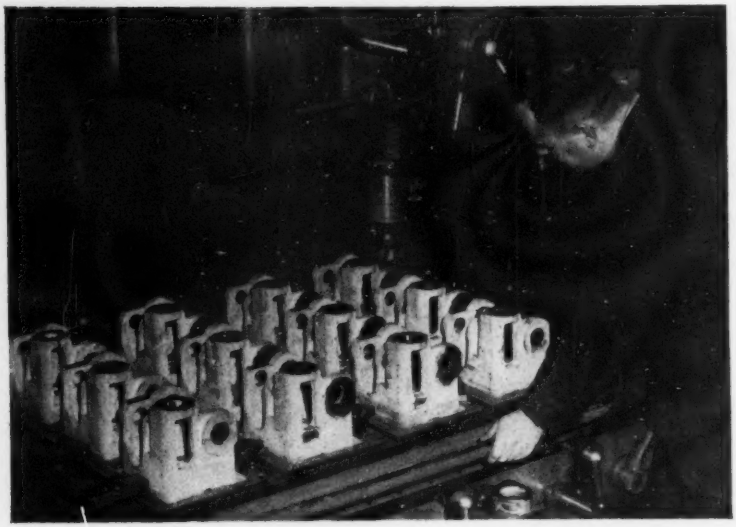


Fig. 8. For the first stage, the components are set up 6 or 12 at a time, as here shown

in each. The counterbores are machined in one pass to diameter limits of ±0·015 in. with a Microbore tool bar, at a feed and speed of 400 r.p.m. and 0·002 in. per rev., and the recesses are end-milled with the Clarkson cutter seen mounted in the spindle. For high-accuracy work of toolroom standard, it would be normal practice to remove the work from the machine between the rough and finish boring stages, in order to allow it to cool. In this instance, however, the limits are such that both stages can be completed at one setting, with a corresponding saving in time.

MACHINING GEARBOX COMPONENTS

A gearbox component, in cast iron, which serves to illustrate typical production boring and milling procedures, is shown in Fig. 7. Initially, each component is milled by conventional methods on the flange face *A*, to establish a datum, and the castings are then set-up in batches of six or 12 on a type 2442 jig borer as shown in Fig. 8. Located by the faces *A*, they are clamped directly to the machine table, and each is milled to the required height on the face *B*, Fig. 7. The hydraulic table feed is employed, and a cut of ¼ in. average depth is taken with a standard 4½-in. diameter face milling cutter.

For the next stage, the components are set up, three at a time, as shown in Fig. 9, and the faces *C* and *D* are milled in a similar manner. Again, approximately ¼ in. of material is removed from each face. The face *C* is machined first, and when the face *D* has been completed, an uncored hole *E* is drilled 1¼ in. diameter, at the same work setting. Next, the hole *E*, and the cored holes *F*, *G*, *H*, and *J*, are semi-finish bored and finish bored with pre-set bar tools, to the following finished diameters: *E*, ⅝ in.; *F*, 2⅛ in.; *G*, 1$\frac{9}{16}$ in.; *H*, 1⅜ in.; and *J*, 1⅞ in., Newall A limits being maintained on each hole. In addition, the hole *H* is counterbored, 1$\frac{7}{8}$ in. diameter, to a depth which is held within ±0·003 relative to the face indicated at *D*.

Each component is then again set up on the datum face *A*, with the previously-machined bores at a specified position in relation to the spindle axis. This setting is effected by means of a dial gauge mounted on the spindle nose, and mandrels inserted in the bores. Once the position has been established, the holes *K* and *L* are drilled 1$\frac{3}{32}$ in.

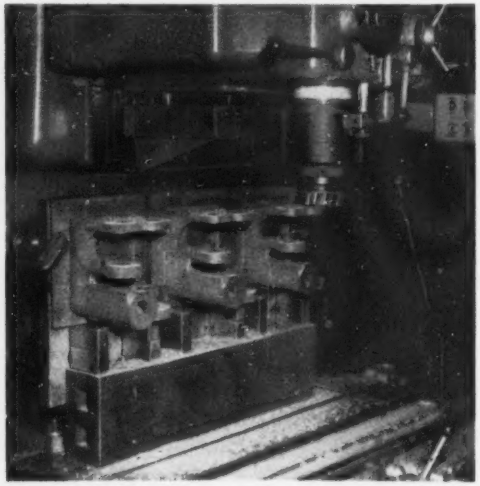


Fig. 9. At this stage, three components are set up for a face milling operation at which approximately ¼ in. of material is removed

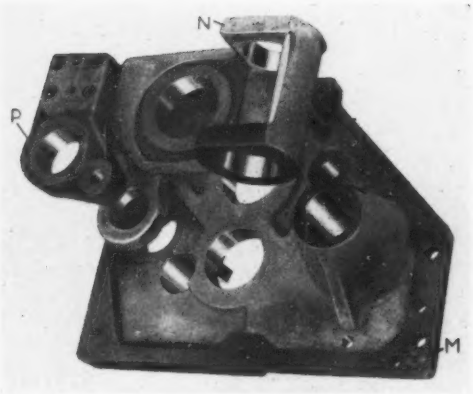


Fig. 10. After preliminary machining on the joint faces, this bracket is assembled to the aluminium alloy "cube" seen in Fig. 11, and the remaining operations are completed in 16 hours

diameter, and the upper hole *K* is finished to 1⅛ in. diameter, Newall A limits, at two stages, with pre-set Microbore tools. The hole *L* is then bored to 1⅛ in. diameter ±0·005 in., at one pass, with a Microbore unit, at a speed of 700 r.p.m., and a feed of 0·002 in. per rev. Finally, the hole *L* is counterbored 1⅛ in. diameter, Newall A limits, in two stages, with Microbore tools.

For these operations, apart from the preliminary milling stage, the total time per part is 93·3 min.

"CUBE" GEARBOX AND BRACKET

In Fig. 10 and 11 are shown two associated components, which serve as examples of facing, boring, and multiple-operation work, and involve the use of the O.M.T. rotary inclinable table. The bracket seen in Fig. 10 is of cast iron, and was originally machined on a jig borer, independently of the cast aluminium "cube" in Fig. 11, in 14 hours. For this component, the machining sequence entailed boring 15 holes, several of which have stepped diameters; milling five faces; and turning two bosses, and threading the bores. In the interests of accuracy and alignment, this procedure has been revised, and it is the present practice to perform all the boring operations on the bracket with the latter attached to the cube, after the mating faces and attachment holes have been machined. Although the total machining time on the bracket is now 16 hours, the increase is justified by the improved accuracy attained.

On the cube component, all six faces must be held square within 0·0003 in., as they are used for datum and location purposes, for maintaining the relationship of the various bores. Machining to this standard of accuracy is carried out by the shave-milling technique already mentioned, with single-point tools of the type seen in Fig. 11. In this way, distortion of the work by excessive cutting loads and heating is avoided. For machining the first face of the cube, it is set-up directly on the jig borer table, and is carefully aligned to the best advantage. This face is then used to locate the work on the O.M.T. rotary inclinable table, on which the remaining five faces are machined at the same setting.

Meanwhile, the joint face *M*, Fig. 10, on the bracket component, is shave milled, and the faces *N* and *P* are also milled flat. The attachment holes on both components are drilled by conventional methods, and those in the cube are tapped. Subsequently, the components are assembled, and set-up on the O.M.T. table as seen in Fig. 12, for the completion of the machining operations, which necessitates boring through the four faces which are at right-angles to the rotary table. In Fig. 12, a pre-set roughing tool is seen in use, on one of the bores in the cube. The sequence includes spigot turning, for which an O.M.T. universal boring head is employed. This head is fitted with a cranked bar mounting a ¾-in. diameter

Fig. 11. Cube casting, set up on an O.M.T. rotary inclinable table, for shave milling to a squareness tolerance of 0·0003 in.

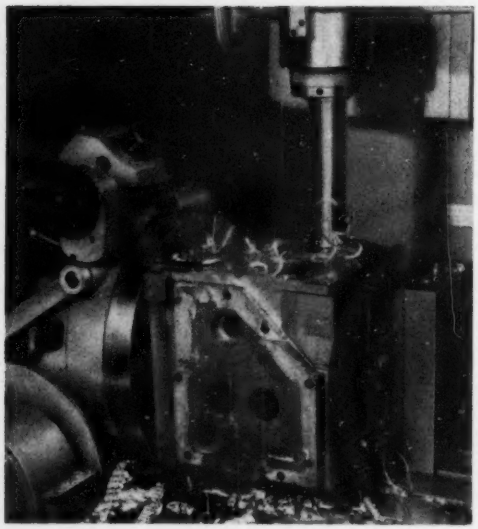
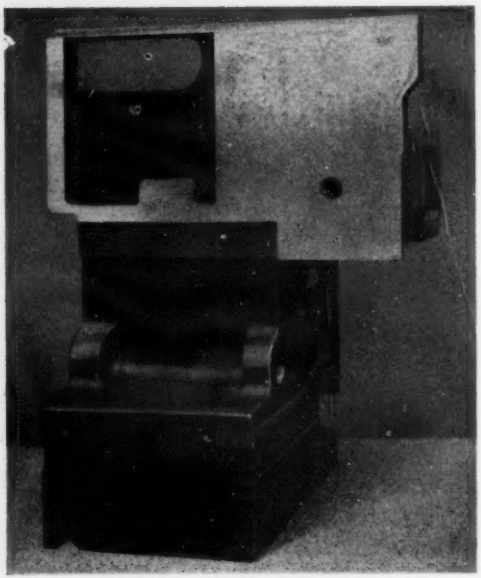


Fig. 12. Cube, with bracket assembled, set up for machining on the O.M.T. rotary inclinable table, which enables the four faces to be presented

Fig. 13. Typical assembly, with mating surfaces finished by shave milling. The top face of the upper casting is shaved parallel with the base slide, within 0·0001 in.



solid carbide cutter, and can be adjusted for diameter while it is running. For a typical spigot turning operation, the cutter is run at a surface-speed of 200 ft. per min., and feeds of 0·004 in. and 0·002 in. per min. are employed for roughing and finishing, respectively.

DOVETAIL MILLING

As already mentioned, important time savings can be obtained by dovetail milling, as an alternative to conventional machining and hand scraping. In addition, a high degree of accuracy can be maintained on the parallelism of the dovetails with other important surfaces, since both can often be

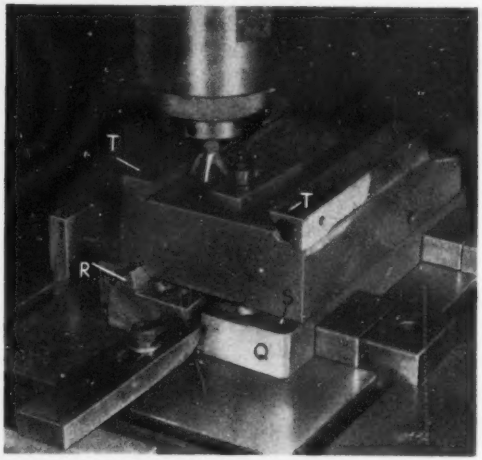


Fig. 14. Set-up for dovetail milling the base slide of the assembly in Fig. 13. The solid carbide 5-tooth cutter is run at a surface speed of 200 ft. per min.

machined at the same setting. An example is afforded by the assembly shown in Fig. 13, in which the two lower castings are of iron, and the upper casting is of aluminium alloy. Each of these castings has shave-milled mating surfaces.

The set-up for dovetail milling the base casting is shown in Fig. 14. It is located, by previously-machined faces, on a plate *Q*, which accurately simulates the bed of the machine whereon the assembly is mounted in service, and incorporates prismatic and flat ways, at *R* and *S*. Before the base casting is set-up for dovetail milling, the bulk of surplus metal is removed by machining a vertical-sided recess, of purely nominal depth, on a shaper.

Fig. 15. This large aluminium alloy gearbox casting is machined to close tolerances, by jig-boring methods, in 14 hours

The special solid carbide cutter employed for dovetail milling is also seen in Fig. 14. It has 5 teeth, which are lapped to close tolerances for concentricity and angle, and the major diameter is 1½ in. This cutter is run at a surface speed of 200 ft. per min., and machining is carried out in roughing and finishing stages. For finishing, a feed of 3 in. per min. is employed. In this instance, the dovetail is slightly tapered, and is checked by means of test balls set at a predetermined distance from each end. A stipulated tolerance of 0·0005 in. on the dimension between the balls is readily maintained. The flat surfaces *T*, it may be noted, are shave milled at the same setting. After the assembly is built-up to the stage seen in Fig. 13, the top surfaces of the upper casting are shave milled parallel with the base slide, within 0·0001 in.

LARGE GEARBOX CASTING

The large aluminium alloy gearbox casting, already mentioned, is shown in Fig. 15, and is machined by jig boring methods in 14 hours. Before this casting is set up on the jig borer, the small joint face, and an associated 6½-in. diameter bore, are machined on a vertical borer. The small joint face then serves as a datum for locating the work for the first stage on the jig borer, at which the large joint face is machined parallel with it, with a face-type milling cutter. Next, the component is turned over on to the large joint face, and is centralized by the 6½-in. diameter bore. At the same time, a previously-marked centre line is aligned with the direction of table motion, and with the work held in this manner, 12 holes are machined from the small end. These holes include a 3-in. diameter bore at the bottom of the 6½-in. bore, and another 3-in. bore, 9 in. deep, to Newall A limits. At the same setting, a face is machined on the casting at *U*, Fig. 15. This face is masked by the projection *V*, and a fly-type cutter is therefore employed.

Next, the work is again turned over on to the small joint face, and is clamped to a locating plate provided with spigots that engage the 6½-in. diameter bore, and a ½-in. hole. The 3-in. diameter bore is then centralized with the spindle. All remaining operations, which include the machining of several other bores, circlip grooves, and rib and boss faces, are then completed.

Murex Alloying Tablets for Aluminium

An agreement has recently been concluded between Murex, Ltd., Rainham, Essex, and a West German firm, for the production and distribution in the United Kingdom and Commonwealth countries of alloys in tablet form based on manganese, chromium, titanium, antimony and copper, for example. These tables are intended to provide an improved and inexpensive means of introducing elements directly into aluminium and its alloys, without the need for "hardeners."

For the production of aluminium hardeners, temperatures which considerably exceed the melting points of the alloys are frequently required in order to ensure complete solution of the elements. In consequence, losses of aluminium and/or the alloying element, and contamination in the form of oxides and gases may occur. Since the alloying element forms only a small part of the final alloy, the aluminium in the hardener must be melted not only when the hardener is being made, but again when the final alloy is being produced.

When the tablets are used, slight turbulence occurs as they pass into solution, and ensures homogeneous distribution of the alloying element, and any other elements already present. Owing to this slight turbulence, little or no mechanical stirring is needed, and as the necessary holding period is very short, virtually no dross is formed. The tablets have cleansing and grain refining properties, and it is claimed that the consequent removal of contaminants results in the production of aluminium alloys with improved flowing and casting characteristics.

Automatic Machine for Statically-balancing Speedometer Drag Cups

In a recent issue of General Motors Corporation, U.S.A., *Engineering Journal*, it was announced that, in response to a demand for an increase in the production of speedometer drag cups, the A.C. Spark Plug Division had designed and built a fully-automatic machine for statically balancing these parts. Hitherto, speedometer drag cups, which must be statically balanced to within 0·0001 oz.-in., had been balanced by means of a fixture which punched one balance hole in the rim of the cup, and then drilled another, larger, hole to effect the final correction. The angular relationship of the first and second holes, and the depth of the latter, were determined by the amount of free angular rotation observed after the first hole had been punched, and with this method the degree of balance finally achieved was controlled entirely by the skill and judgment of the operator.

Although the drag cups were being balanced within the specified limits, the rate of production proved insufficient, and a fixture was developed whereby the unbalance is corrected automatically, without the need for measurements or calculations. A machine was built to incorporate 18 of these fixtures, mounted around the periphery of a rotating table, and the drag cups are loaded and unloaded manually by an operator at one side. As the table rotates—in a clockwise direction when viewed from above—the fixtures pass beneath three stationary cams, which are positioned at approximately 11 o'clock, 2 o'clock, and 5 o'clock, respectively. Each drag cup, which is already assembled on its spindle, is placed in the fixture on a pair of electrically-vibrated jewelled bearings, and the speed of rotation of the table is such that the time required for a fixture to travel from the loading position to the first cam is 10 sec. During this period, the vibrating bearings permit the cup to turn so that it comes to rest with the point of maximum unbalance at the bottom.

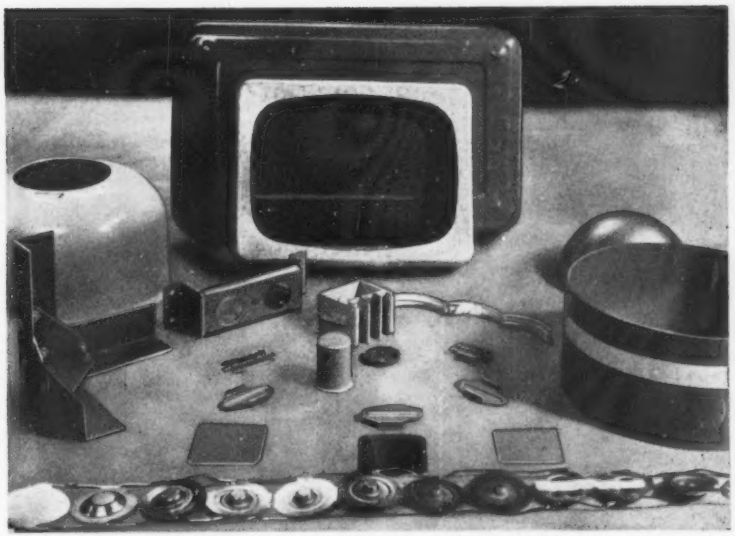
The first cam punches a 0·136-in. diameter hole in the cup, at 30 deg. from the bottom, and during the 10 sec. period required for the fixture to reach the second cam, the cup has turned to bring a fresh point of maximum unbalance to the bottom. At the second cam position, another 0·136-in. diameter hole is punched, again at 30 deg. from the bottom, and, finally, after the cup has turned into a fresh "unbalance" position, a 0·102-in. diameter hole is punched, at the bottom, by the cam at the third station.

Some cups have an original amount of unbalance which is greater than the maximum which the machine will correct, and it was found that such cups turned through less than 70 deg. between the first and second cam positions. A pointer is provided on each fixture to indicate the extent of this particular angular movement, and cups which have turned through less than 70 deg. are left in the machine to make a second circuit, for final balancing.

Although this machine was developed specifically for balancing speedometer drag cups, it is considered that it may be suitable for the static balancing of other components, such as small flywheels and gyroscope discs.

PERMYRON PROCESS FOR COLOURING METALS—A new process for colouring and protecting metal surfaces has been developed by the Alloys and Metals Department, Union Carbide International Co., a division of the Union Carbide Corporation, New York, U.S.A., and it is stated that metals treated by this process can be formed without impairing the finish. Known as Permyron, the process involves applying the pigment, in a suitable vehicle, to the specially-prepared surface by such methods as spraying or roller coating, followed by treatment under controlled conditions of temperature and atmosphere. The resultant coloured finish is durable and chemically and physically resistant to most environments.

At present, the Permyron process has been applied largely to stainless-steels, and is available commercially only for black colouring, but ultimately a range of colours for application to aluminium, plain carbon steels, stainless-steel and other metals will be produced. The Permyron coating is not subject to cracking as a result of the expansion or contraction of the parent metal, and one treated stainless-steel specimen was tested to 50 per cent elongation before any damage to the coloured surface was detected. Permyron-coated stainless-steel sheet has also been deep drawn and bent without cracking or crazing the surface finish. It is stated that any damage caused to the finish can be rectified on site.



Plant for Pre-painted Steel Strip

It has long been recognized that many advantages could be gained from fabricating parts from material which has already had a finishing process applied to its surface. Such an arrangement has been particularly attractive for parts that are formed from sheet materials, such as steel, since it is obviously easier and more economical to apply the required finishing coating to the material when it is in the flat sheet form, thereby simplifying the problems associated with the provision of an even covering, reducing loss of paint from over-spray, and avoiding the handling of bulky and awkward shapes on a "finishing" line. Certain pre-coated materials are already in use, notably tin plate for food containers and galvanized sheet for roofing and other structural applications, but these materials may be considered as exceptions.

A major obstacle to a wider use of pre-coated sheet steel has been the difficulty of developing a coating which would withstand severe forming operations without cracking, flaking, or similar types of failure. In recent years, however, there has been a rapid development with regard to various types of paints, particularly in connection with their properties of adhesion and ductility, and, in consequence, a number are now available which are suitable for pre-coated steel strip. It may be noted that increasing use is already being made of pre-painted steel strip, in coil form, in the U.S.A., and in certain European countries. A new British company has now been established at Bescot, Walsall, for the production of pre-heated and painted steel strip. Known as Coated Strip, Ltd., the company is associated with Graham Firth Steel Products, Ltd., Brockhurst Works, Bescot, Walsall, who produce the steel strip.

If pre-painted steel strip is to be applied successfully, care must be taken in the preparation of the steel surface prior to application of the paint, in selecting a paint which combines the properties required, and in restricting the subsequent forming operations to suit the limitations of the coating. It is obvious that good adhesion between the paint and the steel must be achieved, and, in this connection cleanliness and adequate preparation of the steel surface are of vital importance. Such preparation is commonly carried out by the phosphating or chromating processes. The major factors to be considered in the selection of a suitable paint are the severity of the subsequent forming processes (generally, the most important) and the duty for which the finished part is intended. Examples of typical components produced from pre-painted strip are shown in the heading illustration, and an indication of the extent to which the strip can be formed without

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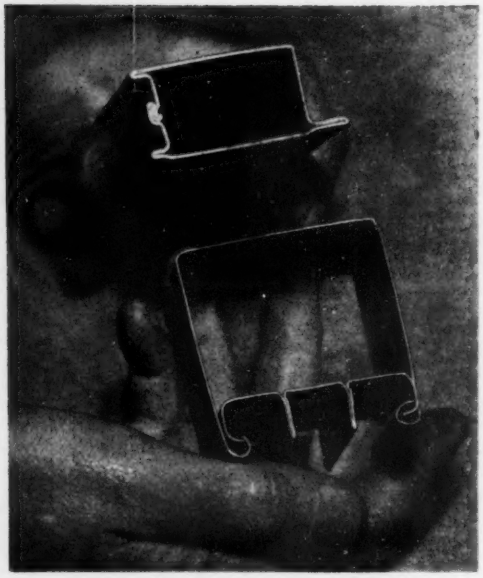

Fig. 1. These items, formed from pre-painted steel strip, indicate the extent to which the metal can be worked without failure of the paint finish

damage to, or failure of, the paint film is given by the sheet steel parts seen in Fig. 1.

The pre-treating and painting line which has been installed at Coated Strip, Ltd., has been designed to receive strip direct from the mill, and is capable of handling aluminium or steel strip up to 16-in. wide, from 0·005 to 0·04 in. thick, at speeds up to 60 ft. per min. In order to make the most efficient use of floor space, the uncoiling and pre-treatment line is arranged parallel with the painting and stoving line, and after the pre-treatment section, the strip travels in a direction that is 180 deg. to its initial path. Fig. 2 is a view from the starting end of the line, and the first machine is a capstan type uncoiler, seen at the left. This uncoiler is fitted with a double head, and is swivel-mounted to provide for continuous running. From the uncoiler, the strip passes to the vertical-type accumulator (seen beyond the uncoiler in the line), and between the uncoiler and accumulator there is a spot-welding unit for joining the strip from successive coils into a continuous length.

THE PRE-COATING PROCESS

On leaving the accumulator, which operates as a "storage bank" to maintain the flow of strip while the spot-welding operation is being carried out, the strip enters the 6-stage degreasing and pre-treatment plant, the exit end of which is shown in Fig. 3. Of the spray-type, this plant is 60 ft. long, and in the first section Parcolite (The Pyrene Co., Ltd.,) is employed as the degreasing medium, a working temperature of 150 deg. F. being maintained. On leaving the end of the first section, and all subsequent sections, the strip passes through a pair of spring-loaded squeegee rolls. These

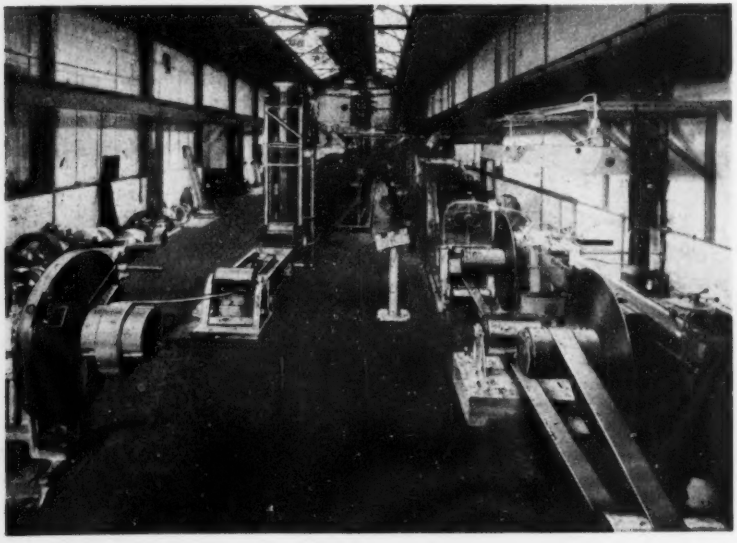

Fig. 2. General view of the steel strip pre-treatment and painting line installed at Coated Strip, Ltd. The strip is fed to the line from the uncoiling machine at the left, and after being turned through 180 deg. at the far end is re-coiled on the machines in the right foreground

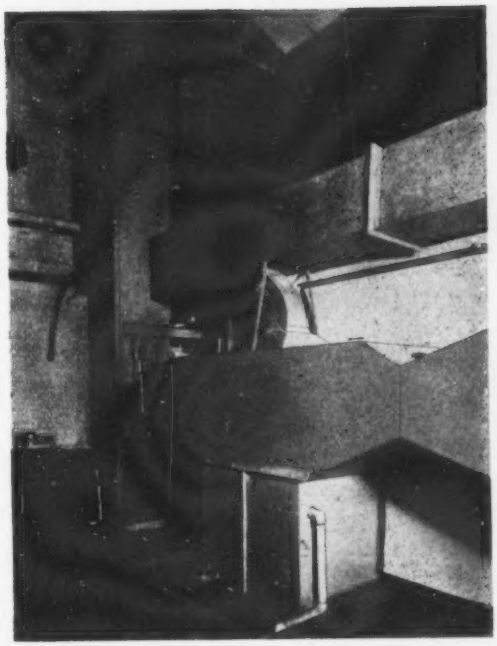

Fig. 3. The exit end of the 6-stage degreasing and pre-treatment section. In the latter stages of this section, there is a phosphating tank and a chromate rinse

rolls are swivel-mounted, to allow the strip to float and to provide a certain amount of corrective centralization to the strip as it enters the succeeding section. The second and third sections apply a cold and hot rinse, respectively, the latter operating at 150 deg. F., and the strip then proceeds to the fourth stage, where it is subjected to a phosphating treatment. For this treatment, Bonderite 900 (The Pyrene Co., Ltd.) is employed, and the working temperature is 170 deg. F. A further hot rinse at 150 deg. F. is provided in the fifth section and at the sixth, and final, stage, the strip is given a chromate rinse. For those sections were heat is required, gas-fired immersion tubes are used, the temperature being controlled by means of thermostats.

After the chromate rinse, the strip passes into a drying oven which is located at the extreme end of the left hand line in Fig. 2, and it is at this point that the direction of flow of the strip is changed, as mentioned earlier. The drying oven is of the gas-fired vertical-type, with thermostatic control, and as it travels to the top of the tower, the strip is twisted and turned through 90 deg., by means of rollers, so that it is travelling at right-angles to the degreasing plant. From the top of the drying oven, the strip is fed to the top of a vertical cooling tower, which has a twisting roller whereby a further turn of 90 deg. is imparted, with the result that when the strip leaves the bottom of the cooling tower it is moving parallel with, but in the opposite direction to, the strip passing through the degreasing plant.

Immediately adjacent to the cooling tower, there is a de-burring unit, which serves to remove any sharp edges from the strip before it is fed into the coating machine. This coating machine is believed to be the first of its type to be used in this country, and provides for coating both sides of the strip at a single pass. Moreover, the paint or lacquer applied to each side can be of the

Fig. 4. A view of the paint coating machine from the exit side. This unit, which has been specially developed, provides for coating both sides of the strip at one pass, with paints or lacquers of the same or different type and colour

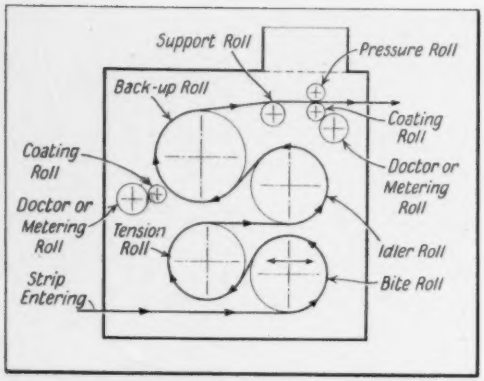

Fig. 5. Diagrammatic layout of the paint coating machine, showing the various rollers employed and the path taken by the steel strip

same, or different, type and colour. A view of the coating machine from the exit side is given in Fig. 4, and Fig. 5 is a diagrammatic layout of the path of the strip through the various rollers employed. At both painting stages, that is for the upper and lower sides of the strip, there are paint trays (not shown in Fig. 5) with a pick-up roller partially immersed in the paint. This roller runs in contact with an applicator roller, and an adjustment is provided for varying the centre distance of these two rollers so that the thickness of the paint film can be adjusted. It is stated that the thickness of the wet film can be controlled between 0·001 and 0·002 in., and between 0·0005 and 0·0008 in. when dry, and that the resultant finish on the strip is free from pin-holes, cissing, and orange-peeling.

Provision is made on the machine for carrying out either direct- or reverse-coating of strip, that is, applying the paint with the applicator roller running in the same direction as the travel of the strip, or opposed to it. Since both sides of the strip are wet when it leaves the coating machine, it is not possible to employ any form of support to take up the sag, and the latter is therefore controlled by means of a special built-in hydraulic tensioning unit.

On the outgoing side of the coating machine, there is an open space through which the strip passes, to permit flow-out and flash-off, before it enters the stoving oven. This unit is approximately 60 ft. long, and is of the fully-recirculating type. There are two gas-fired combustion chambers, each connected to a large-volume centrifugal circulating fan, and an extensive ducting system has been provided for the complete length of the oven to ensure that the correct time/temperature relationship can be obtained. The temperature is monitored at five positions throughout the length of the oven, thereby enabling the duct system to be adjusted to give the correct stoving pattern. Depending on the type of coating and the gauge of metal being treated, it has been found that temperatures between 500 and 600 deg. F. give the most satisfactory results.

At the exit side of the drying oven, it is possible to provide the first support for the strip since it left the coating machine (a distance of some 65 ft.). From the oven, the material passes to the cooling section, where it is subjected to a spray of cold water from a number of noz-

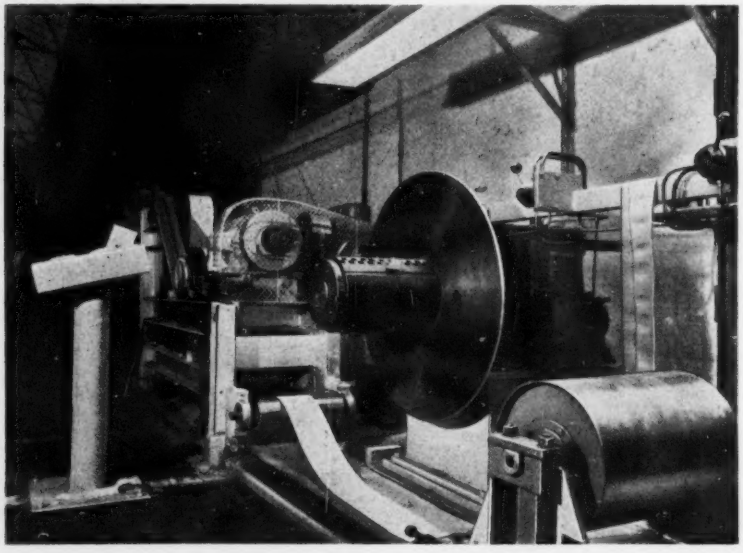

Fig. 6. A view from the finishing end of the line. The variable-speed drive unit for pulling the strip through the entire plant can be seen in the right foreground

zles, and, on leaving this section, it passes through a pair of squeegee rollers, to remove excess water and, finally, to an "air knife," which completes the drying of the surface.

At the end of the line is the drive unit, which pulls the strip through the complete plant from the uncoiling reel. The drive unit incorporates rubber-covered feed rollers in conjunction with nip rollers, the latter being spring-loaded to accommodate the increased thickness of the strip at a join without damage to the unit. A variable-speed motor is employed, and the drive is transmitted to the feed rollers by means of chains, the traverse rate of the strip ranging from 32 to 60 ft. per min. Finally, the strip passes to a pair of motor-driven re-coiling machines, arranged for continuous operation. These machines, one of which is shown in Fig. 6, are fitted with slipping clutches and hydraulically-operated push-off mechanisms. The control console for the entire plant is located adjacent to the first re-coiling machine, and is seen at the left in Fig. 6.

This pre-coating plant was designed and installed by Stordy Engineering, Ltd., Wolverhampton, the coating materials were developed and supplied by Robert Ingham Clark & Co., Regent Street, London, W.1, and the chemicals for the pre-treatment section of the plant were supplied by The Pyrene Co., Ltd., Great West Road, Brentford, Middx.

Autoduo Loading Equipment for Hydrax Gear Hobbing Machine

By PRECEPTOR

With the continued reduction of cutting times, automatic work loading arrangements for high speed gear hobbing machines are assuming increasing importance. The Autoduo loading equipment, seen fitted to a No. 7 Hydrax automatic high speed hobber in Fig. 1, has recently been introduced by the Machine Tool Division of David Brown Industries, Ltd., Sherborne Street, Manchester, 3, to supplement the indexing drum and transfer-type loaders previously available for these machines.

The machine illustrated is destined for the Coventry works of Joseph Lucas, Ltd., and was recently demonstrated on screw sleeve splines for motor car starter units, which were hobbed at the rate of 180 per hour. This component is of 1⅝ in. diameter by ¾ in. wide and has three helical splines of 45 deg. lead angle. A 3¼-in. diameter, single-start hob is run at 3,000 r.p.m., to give a cutting speed of 250 ft. per min., and two components are completed at each cycle.

Two vibratory bowl feeders deliver the blanks to a duplex magazine, which may be seen more clearly in the close-up view, Fig. 2. From the magazine, two blanks are transferred, by horizontal movement of a hydraulically-operated plunger,

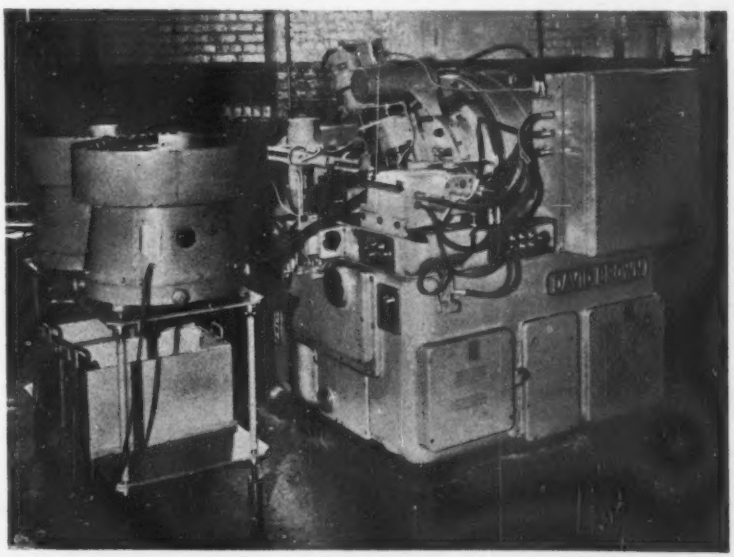

Fig. 1. David Brown No. 7 Hydrax automatic high speed hobbing machine equipped with the Autoduo loader

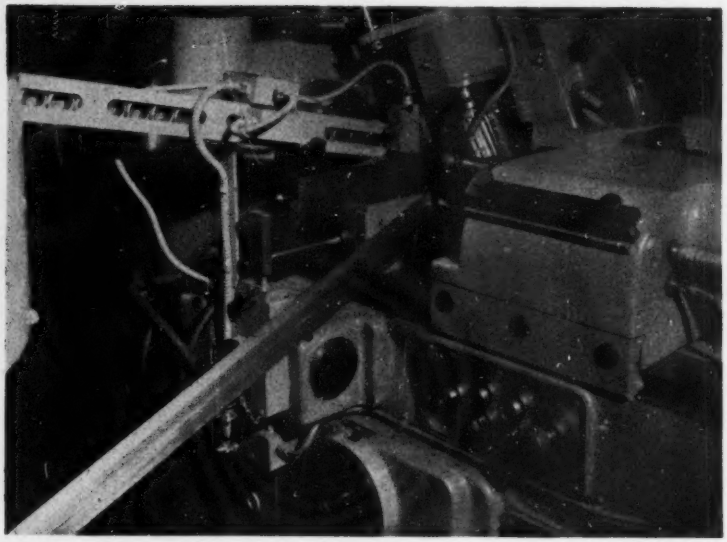

Fig. 2. A close-up view of the Autoduo loading equipment on the Hydrax hobbing machine. The component is a screw sleeve spline for a motor car starter

into an opening in a loading slide. At the same time, the two components which were hobbed at the preceding cycle are ejected from the slide and fall into the discharge chute. A sequence valve is then operated, and the loading slide is advanced hydraulically to bring the blanks into line with the work spindle axis. At this position, another sequence valve is actuated, and a mandrel, carried by the tailstock spindle, is advanced to pick up the blanks and move them clear of the loading slide. Operation of a third sequence valve now causes a collet on the work spindle to close and grip the mandrel, after which the machine cutting cycle is initiated by a pressure switch.

When the hob has been fed into the work to the required depth, the cross feed is engaged, and at the completion of the operation this movement is stopped by a limit switch. The hob is then withdrawn, and returned to the starting position by rapid cross traverse. Operation of a further limit switch next causes the collet to open, and the mandrel is withdrawn, leaving the hobbed components in the loading slide. At the end of this movement, a valve is opened which causes the transfer plunger and the loading slide to withdraw. The plunger stroke is completed before that of the loading slide, and by the time the latter has returned to the position shown in Fig. 2, two more blanks have dropped from the magazine in front of the plunger. At the end of the return stroke of the slide, a switch is operated to start the next cycle. Hydraulic power for operation of the loading equipment is provided by the machine circuit.

If required, the machine may be quickly changed over from automatic to hand loading.

New Magnesium-based Alloys

New magnesium alloys, known as M.S.R.(A) and M.S.R.(B) have been developed by J. Stone & Co., Ltd., Woolwich Road, London, S.E.7, a member company of the J. Stone (Holdings) Group. These alloys have proof stress values hitherto associated only with aluminium-based types, and it is stated that a variety of proof stress values and elongation figures can be obtained by adjustments of the 2-stage heat-treatment and the composition, or a combination of both.

It is claimed that proof stresses up to 13½ tons per sq. in. are obtainable in conjunction with a low ductility value, but castings currently being produced in these materials have tentative specifications as follows, the figures referring to the *A* and *B* grades respectively: 0·1 per cent proof stress—not less than 10 and 11 tons per sq. in.; ultimate tensile stress—not less than 15 tons per sq. in.; and elongation—not less than 4 and 2 per cent.

These alloys have a density of 1·82 gm. per c.c., and exhibit good resistance to creep at temperatures of the order of 200 deg. C. Investigations have suggested that the alloys, which have good casting properties, will be suitable for engine components, and other parts which are subject to long-term heating, also for missile applications, where short-term heating is encountered. The M.S.R. alloys can be welded and are resistant to stress-corrosion.

Mécanélec Exhibition, Paris—1

Reference has already been made in MACHINERY, 93/1,000—29/10/58, to the Mécanélec exhibition which was held in Paris from September 12 to 21 to mark the approach to completion of the Centre National des Industries et des Techniques (C.N.I.T.). Some of the outstanding features of this striking new building, stated to be the largest exhibition hall of its kind in the world, have been described, and details are here given of certain of the machine tools that were on view.

H.E.B. S-TYPE PILOTE COPYING LATHE

The French firm H. Ernault-Batignolles [Drummond-Asquith (Sales), Ltd.] have now added to the well-known H.E.B. range the S-type Pilote hydraulic copying lathe shown in Fig. 1, which incorporates a number of features to provide for easy change-over of the automatic cycle from one job to another, so that both large and small batches of work can be handled economically. It will swing 18 in. over the bed and can be supplied to admit either 20 in. or 40 in. between centres.

On this new lathe, the automatic cycle is controlled by a combination of two perforated cards which are mounted on indexing drums and operate micro-switches. These cards can be readily prepared by the operator, if desired, without reference to any system of coding. The perforations take the form of rectangular apertures cut in the card at appropriate positions, and they can be arranged to control all the functions of the automatic cycle, comprising, for example, starting and stopping the spindle and coolant flow, engaging and stopping the feed and rapid traverse motions of the tool slides, and changing the rate of feed while cutting is in progress. Up to four cuts can be taken on the workpiece during the cycle, also under the control of the cards.

Moreover, in order to facilitate change-overs, graduated dials and scales are provided for all adjustments, for use in conjunction with a standard form of setting sheet, prepared after the machine has been set up for the first batch of a particular component. On this sheet are entered the scale and dial readings relating, for example, to the positions of the support brackets for the master, the tailstock, the tool slides, and the turret depth stops of the re-cycling mechanism, which determine the amount removed from the workpiece at each pass. The speed and feed change gears to be used are also indicated.

In this manner, the machine can be rapidly set up, at any time, without the need for special skill, in exactly the same way as for the initial batch. For long runs of work, the perforated cards can be replaced by a more permanent arrangement of trip collars on the two control drums, and there is provision for locking the various machine adjustments to ensure that the set-up remains undisturbed. Push-button and joystick controls, on a conveniently-arranged movable panel, permit the machine to be operated entirely by hand, for setting purposes, also for producing small quantities of components which do not warrant the preparation of perforated cycle cards.

Main driving motors from 15 to 30 h.p. can be fitted, and change gears provide two ranges of

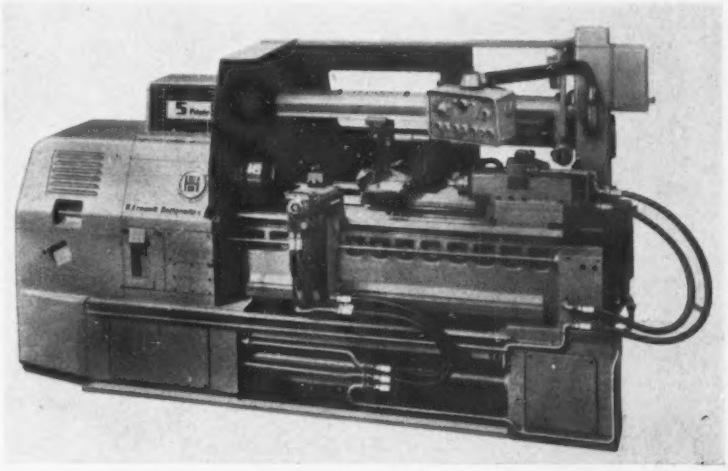

Fig. 1. H.E.B. type S Pilote hydraulic copying lathe incorporating facilities which enable a set-up to be very rapidly changed

speeds from 100 to 500 r.p.m. and 630 to 3,150 r.p.m., the low range being obtained through a back gear. The spindle is bored 2$\frac{1}{16}$ in. diameter and has an A1, 6-in. nose, with a No. 7 Metric internal taper. The hydraulic copying carriage moves on hardened and ground ways at the rear of the bed, and a hydraulically-operated in-feed slide is provided at the front. Coarse feeds from 0·0035 to 0·035 in. per rev. and fine feeds from 0·0014 to 0·014 in. per rev. are obtained from a gearbox, and the change from one range to the other is effected by means of electro-magnetic clutches.

The tailstock, which is hydraulically-operated, incorporates a rotating centre, and a hydraulical chuck can be fitted if desired.

SCULFORT SUPERCAP HEAVY-DUTY CENTRE LATHE

A new design of centre lathe, intended for heavy-duty, which has been introduced by Ets. Sculfort-Fockedey, Vautier & Co. (Rudolph Carne & Co., Ltd.) is shown in Fig. 2. Known as the Supercap, it is being built with centre heights of 14, 16½ and 19½ in., and with bed lengths to accommodate from 5 ft. to 26 ft. between centres. When a gap-bed is provided, the maximum turning diameters for the three sizes of lathe are 45 in., 49 in., and 54 in. The bed, which is 26½ in. wide to ensure adequate rigidity, has flame-hardened and ground vee and flat ways. Work-pieces weighing up to 8 tons can be mounted between centres.

Driving motors from 16 to as much as 50 h.p. can be provided, and the geared headstock gives 24 spindle speeds which may range from 20 to 1,600 r.p.m. when a 50-h.p. motor is employed. The spindle has a standard A1, 11-in. nose, with a No. 6 Morse internal taper. A total of 54 sliding and surfacing feeds is available, also power feed to the top slide, and a full range of metric, module, inch, and diametral pitches can be obtained without the use of change gears. A coarse-pitch screw-cutting device, with a ratio of 10 to 1, is incorporated, for use with the 12 lowest spindle speeds. Precision length stops are provided for the sliding and surfacing motions, and the controls on the apron include means for reversing the direction of feed.

A 16½-in. Supercap lathe, driven by a 40-h.p. motor, was demonstrated at the exhibition using Ceroc sintered-ceramic clamped-tip tools. Cuts 0·2 in. deep were taken on 45-ton steel at a speed of 900 ft. per min. (345 r.p.m.), with a feed rate of 0·020 in. per rev. Detailed reference has already been made to these Ceroc tools in MACHINERY, 91/1420—20/12/57.

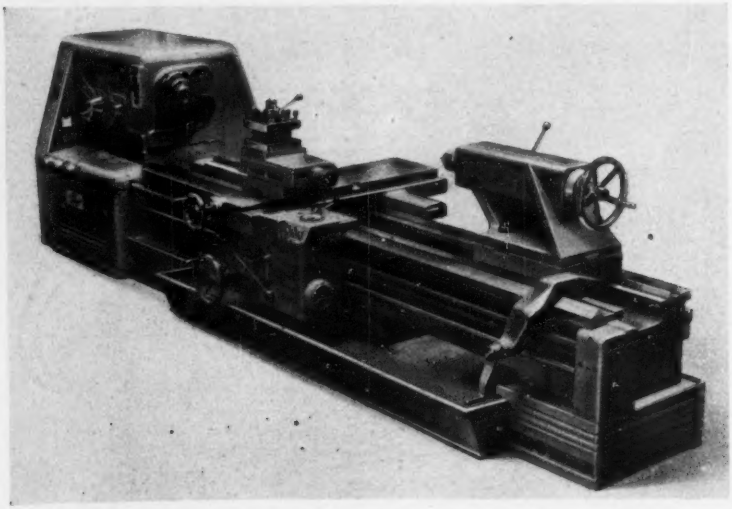

Fig. 2. Supercap heavy-duty, high-speed centre lathe, introduced by Ets. Sculfort-Fockeday, Vautier & Co.

PRECIMO HOBBING MACHINES

La Précision Moderne, Paris (Buck & Hickman, Ltd.) makers of the Precimo hobbing machines, demonstrated a type H.R.3, of 250-mm. (9·8-in.) capacity, and a type H.R.2, of 150-mm. (5·9-in.) capacity, both of which were fitted with ring-type magazine loading equipment. The type H.R.3 machine is illustrated in Fig. 3, set up for handling alloy-steel cluster gears for the Renault Dauphine car. Two operations are performed separately on this part. First, a right-hand helical gear of 33-deg. helix angle with 21 teeth of 2 module, and a face width of 15 mm. (0·59 in.) is cut in a cycle time of 1 min. 26 sec. At the second stage, a 27-tooth by 2 module, right-hand helical gear, of 30-deg.

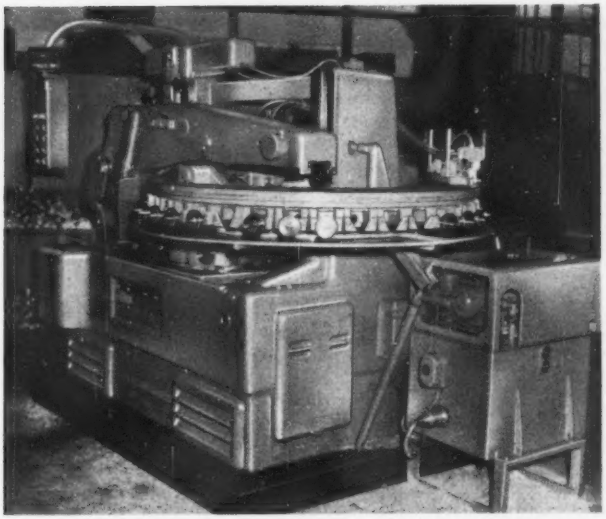

Fig. 3. Precimo type H.R.3, high-speed hobbing machine with ring-type magazine for handling cluster gears

helix angle and 12-mm. (0·47-in.) face width, is cut in a cycle time of 1 min. 30 sec. A solid, high-speed steel hob of 4 in. diameter is employed.

Loading and unloading of the work are performed by hand on this machine. The indexing, ring-type magazine, provided with location nests for the workpieces, is carried on the rising and falling work-head of the machine, and is supported by means of a link arrangement anchored to the tailstock column. After the magazine has been indexed, a fresh blank is brought to the hobbing position by movement of the hydraulically-operated tailstock centre.

On the Precimo H.R.3 hobbing machine, hob speeds up to 450 r.p.m. are provided when a differential is fitted, and up to 600 r.p.m. when it is supplied without a differential. The hob spindle head can be pivoted in both directions, up to 90 deg., which enables helical gears with high helix angles, also multiple-thread screws to be hobbed. Two types of automatic cycle may be employed, the first of which provides for: (1) rapid down-feed of the work-head to the required depth of cut; (2) engagement of the hob spindle and work-head drives; (3) engagement of the horizontal feed; (4) stopping of the feed at the end of the cut; (5) rapid vertical traverse of the work clear of the hob; and (6) rapid return of the hob slide to the starting position. With the second type of automatic cycle, rotation of the hob and work starts simultaneously with a slow down-feed of the work-head, which continues until the required depth of cut is reached, whereupon the horizontal feed is engaged. This method reduces the time of entry of the hob into the cut, and offers particular advantages when hobbing helical gears. Teeth which do not extend over the full width of the blank can also readily be hobbed with this working cycle. A semi-automatic or a fully-automatic hob shifting device can be incorporated, and with the fully automatic device, which is hydraulically operated, the hob can be shifted by a predetermined amount after each workpiece has been hobbed, or after a preset number of cycles. A signal lamp warns the operator when the hob should be removed for regrinding.

The smaller Precimo hobbing machine, type H.R.2., which is generally similar in design to the H.R.3., was fitted with a ring-type magazine, arranged, for convenience, at an angle, and not horizontally, as in Fig. 3. The blanks were loaded by hand, but the hobbed gears were ejected automatically by means of a solenoid-operated pusher.

MAPE-QUALITEX SPARK EROSION TOOL SHARPENING MACHINE

Société Mape, 124 Rue d'Alembert, Grenoble, France, have introduced a spark-erosion tool-sharpening machine, as shown in Fig. 4, which operates by the patented electro-mechanical system developed by the French firm Qualitex, Dunod & Co., Paris. It is of the same general design as a normal tool sharpening machine except that the lapping wheel is replaced by a brass electrode disc of 8 in. diameter, which is driven by a 1 h.p. motor running at 1,450 r.p.m. The required spark gap is maintained by vibration of the electrode disc at a high frequency (1,000 cycles per sec.) and a low amplitude, while dielectric fluid is delivered by a motor-driven pump with a capacity of 9 gal. per min. All the electrical equipment, together with the pump unit and an exhaust fan for removing fumes from the working area, is housed in the base of the machine.

A 3-position selector switch permits the sharpening operation to be carried out in roughing, semi-finishing, and finishing stages, either by the off-hand method, or with the tool clamped in a holder on the 21¼- by 10¾-in. work table. The latter

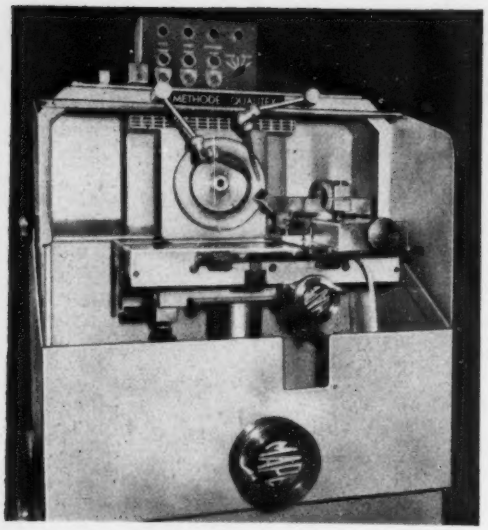

Fig. 4. Mape spark-erosion tool sharpening machine incorporating the Qualitex system of spark generation

can be tilted to a maximum angle of 20 deg. in each direction to produce positive or negative rake, and micrometer cross adjustment is provided for the toolholder. Longitudinal hand traverse is provided for the table, through a distance of 6 in., and there is a vertical adjustment, by screw, of 5 in. All sizes of tools up to 2-in. square shank can be handled on this machine.

QUALITEX-DUNOD PORTABLE EQUIPMENT FOR DEPOSITING HARD METALS

Qualitex-Dunod & Co. (Elgar Machine Tool Co., Ltd.) have introduced a portable spark generator and vibratory hand tool—known as the Cardureur, whereby a layer of hard metal, only a few thousandths of an inch thick, if required, can rapidly be deposited on the cutting edges of all types of tools, also on the wearing surfaces of components, to obtain increased life. In Fig. 5, the equipment is being employed to deposit a layer of tungsten carbide on the teeth of a high-speed steel milling cutter. An increase in life of at least 30 per cent, and often very much more, is said to result from this treatment. Of particular interest is the application of the process for reclaiming files, which is reported to have proved very effective.

E.A.M. PRECISION GAUGING EQUIPMENT

The French firm Electronique Appliquée à la Mécanique (Electronic Gauges, Ltd.), makers of the well-known Stop Cote caliper grinding gauges, which operate on the principle of balanced capacitance, demonstrated a recently-developed type, for diameters from 1 to 25 mm. (0·040 to 1 in.) on a Gendron RP15/50 cylindrical grinder. The set-up is shown in Fig. 6, and the gauge automatically controls the size of a shaft component to provide a specified fit in the bore of a selected mating part. Grinding size is determined by the mating part itself, which is placed on a plug gauge unit A, coupled electrically to the Stop Cote control panel. The caliper gauge, pivoted on the wheel-head, is swung down into engagement with the workpiece automatically, at the start of the cycle, by means of a hydraulic cylinder and linkage, and is retracted when the operation has been completed.

This company also showed various types of high-production gauging equipment developed for use in the ball and roller bearing industry, including an automatic machine for sorting taper rollers into 11 grades, and plus and minus rejects. Provision is made for measuring taper, diameter, and length, and outputs ranging from 1,500 to 5,000 pieces per hour can be obtained depending upon the size of the roller. For ball sorting, machines can be supplied for grading in steps of ¼ micron (0·00001 in.).

Fig. 7 shows equipment which the company has developed for selection of a set of graded balls, and assembly into an inner and outer bearing race to provide a specified running fit. On the left is

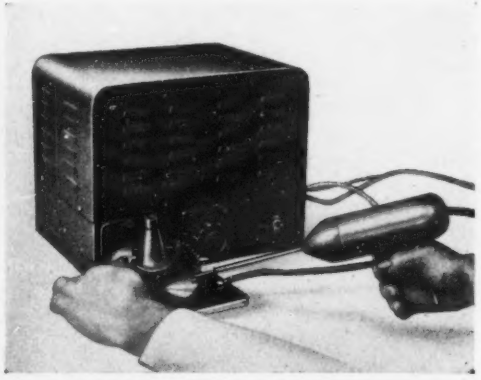

Fig. 5. Qualitex Cardureur hand tool and portable spark generator for hard facing by the application of tungsten carbide

the gauging unit, fitted with a mandrel, at *A*, to receive the outer race, and a cup *B* for the mating inner race. Measurement of the races, to determine the grade of balls required, is effected through the medium of master balls in the mandrel and cup—six per set—which are held in contact with the raceways by spring pressure, and are retracted by finger levers, as at *G*, to allow the races to be placed in the gauging position.

The associated electronic gauge in this left-hand unit can be pre-set to select a grade of ball appropriate to the fit required, and the grade is indicated on a meter. In the right-hand unit there is a bank of hoppers *D* for storing balls of 11 grades, and when a push button at *E* is depressed, one of a series of relays is energized and a predetermined number of balls of the correct grade is delivered into the tray at *F*. The latter is provided with a delivery nozzle *C*, fitted with a thumb-lever release, which enables the balls to be easily assembled into the bearing races. The whole operation of gauging and assembly requires only a few seconds. Units of the type shown have been supplied to some well-known firms in this country, as well as to ball bearing manufacturers on the Continent.

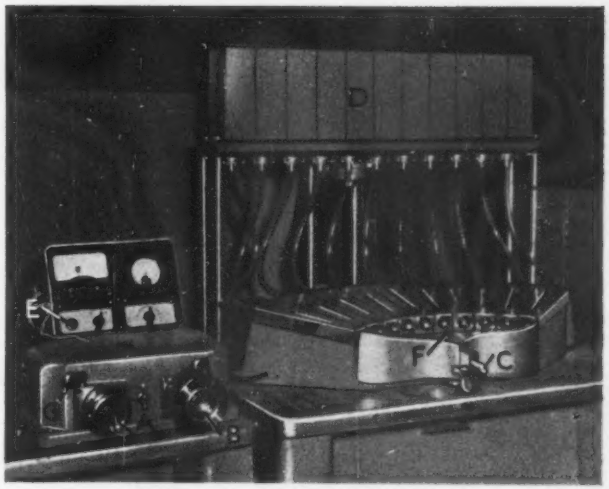

Fig. 7. E.A.M. equipment for gauging ball races and automatically selecting a set of graded balls to give a specified running fit

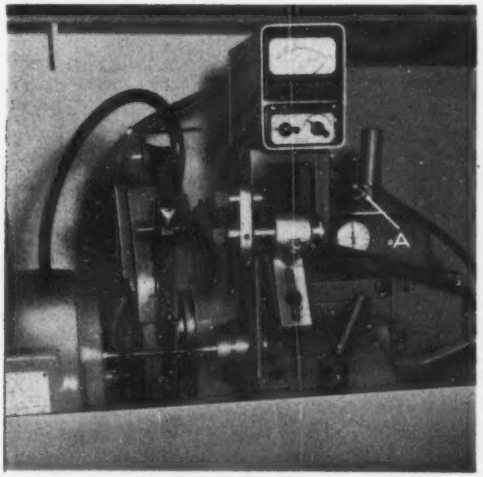

Fig. 6. Stop Cote electronic caliper gauge, set up on a Gendron grinder, for automatically sizing shaft components to suit the bores of mating parts

Of particular interest is a machine, shown in Fig. 8, which has been built for the automatic grading of germanium wafers used in the manufacture of transistors. These wafers range in size from 1½ mm. to 4 mm. square (0·060 to 0·160 in.) and are only about 0·004 in. thick, so that a number of difficult handling problems had to be overcome. The machine shown is capable of sorting germanium wafers into 11 grades, in 2-micron (0·00008 in.) steps, and plus and minus rejects, at the rate of 1,800 per hour.

The wafers to be graded are loaded, away from the machine, into 10 holes located on a pitch circle in a transparent plastics block of approximately 2 in. diameter. These 10 holes extend completely through the block, and there is a centre hole whereby the block is located and clamped, by a knurled nut, on a vertical spindle in the machine. When the stack of wafers at one position has been graded, the magazine block is indexed, through 36 deg., to bring the next into position.

Wafers are picked up, in turn, by a suction pad on the under-side of a rising and falling pivoted arm, which then swings round and deposits the wafer in a nest on a 4-station indexing plate. The latter indexes in a clockwise direction to bring the piece into position beneath an electronic gauging head at *A*. The suction pipe to the pick-up head can be seen at *B*. In the magazine, the stack of wafers is supported from beneath on a pusher

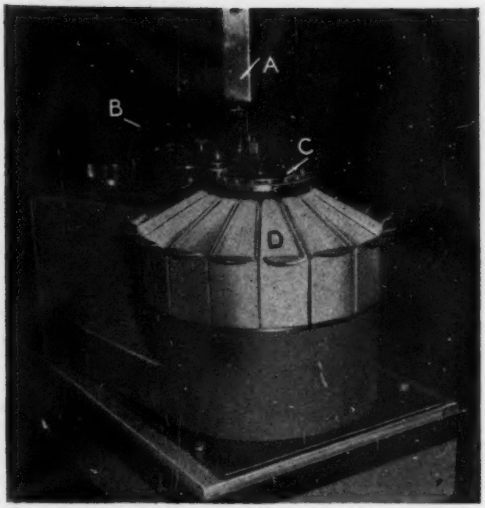

Fig. 8. E.A.M. machine developed for automatically grading germanium wafers, only 0·004 in. thick, used in the manufacture of transistors

bar, which is indexed upwards in increments to maintain the top wafer at a constant level. After the wafer has been measured, the carrier plate indexes again and the piece falls by gravity out of the nest into one of the pockets of an indexing distributor plate *C*, whereby it is delivered to one of the trays *D*, according to the grade. Machines of the type shown are to be supplied to the Thomson-Houston company in France, and to R.C.A. in the United States.

Reference may also be made to an automatic machine which the company has built for the Renault company in France for inspecting steel centring sleeves for crankshaft main bearing caps, at the rate of 2,000 per hour . The internal and external diameter and the length of the sleeve are gauged, and provision is also made for checking that the ends have been chamfered, to facilitate assembly of the sleeves into the caps. On the production line, the assembly of the sleeves, caps, and fixing bolts is carried out automatically.

DUFOUR PROFILE MILLING MACHINE FOR TURBINE BLADES

In Fig. 9 is shown a profile milling machine for use in the production of blades for steam turbines and compressors which is being built by Dufour Père & Fils & Cie., Levallois-Perret (Seine), France. It is controlled by the Herlicq electric copying system and is based on a machine of patented design, developed originally for mechanical copying by a French shipbuilding firm.

The machine is intended solely for milling outside contours, and will handle blades from 5⅞ to 15¾ in. long. A pair of right- and left-hand, interlocking slab milling cutters, of 120 mm. (4¾ in.) diameter, is mounted on a horizontal arbor located to the rear of the work spindle. The latter, indicated at *A*, rotates continuously and carries three fixtures so that blades can be loaded and unloaded while milling is in progress. To control the profile produced, two 3-lobed templates of sheet metal are mounted in holders on a splined shaft *B*, which is coupled by gears to the work spindle and rotates in unison with it. These template holders are adjustable along the splines, and the lobes on each template correspond to the form which is required at one end of the blade.

Stylus rollers, carried on the two sensing heads *C* and *D*, and of the same diameter as the cutters, make contact with the templates. The form is produced on the blade by the continuous rotation of the work spindle, in conjunction with transverse movement, along the guideways *E*, of the base member of the housing which carries the work and template spindles. This housing is pivoted about a vertical axis at the left-hand end of the base, and the action of the two templates causes it to oscillate, as the work rotates, so that the form is milled at varying angles to the mounting axis of the blade. The total movement of the transverse slide is 9⅜ in.

Machining is carried out by climb milling, and to provide for an approximately uniform rate of metal removal from the initially rectangular blank, four rates of work rotation can be automatically engaged during the cycle, according to the setting of adjustable selector dogs on the drum *F*, on the template spindle. These dogs actuate switches for controlling a 2-h.p. variable-speed motor, with a range of 300 to 3,000 r.p.m., which drives the work spindle.

Drive to the cutter spindle, also to the electromagnetic reversing clutches for the stylus-controlled copying movements, is taken from a 10-h.p. constant-speed motor, and five spindle speeds, from 40 to 60 r.p.m., are obtainable through change gears. There is a separate, ½-h.p., motor for rapid rotation of the work spindle, and provision is made for adjusting the work by hand, in relation to the milling cutter, for setting the depth of cut. All the electrical controls are grouped on the panel seen at the right. It is stated that blade profiles can be produced to an accuracy of 0·002 in., and with a very high standard of finish, so that only a small amount of polishing is subsequently required.

Usually, the blade is located in the fixture by the previously-milled internal form, and in this connection it may be noted that the machine can be conveniently employed for profile-milling the fixture location blocks. The weight of the machine is approximately 5 tons.

BLUME & REDECKER FULLY-AUTOMATIC COIL WINDER

The German firm of Blume & Redecker (Avo, Ltd.) have developed a fully-automatic machine, seen in Figs. 10 and 11, for producing wave-wound coils of the type used in the radio and television industry, which is stated to represent an important advance on any equipment previously employed for this purpose. Known as the type KW5B, it incorporates a vibratory hopper feed unit for the spools, and the finished coils are automatically ejected. Consequently, apart from the fact that the cycle time is considerably reduced, as compared with existing methods, one operator can tend up to six machines.

Referring to Fig. 11, the spools are delivered from the hopper into a discharge channel whence they are loaded, in turn, by means of a transfer arm and vertical pusher bar, on to a freely-rotating mandrel at A, on a 4-station turret. The latter indexes in an anti-clockwise direction and is mounted on a slide which moves along round guide bars on the bed. Indexing takes place during the backward stroke of the slide, and this movement

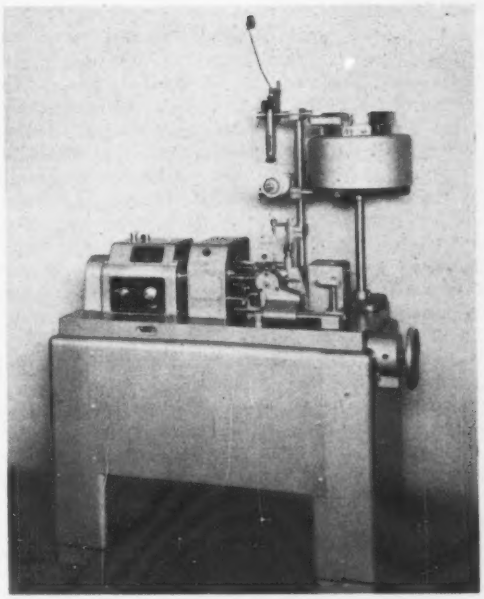

Fig. 10. Fully-automatic machine developed by Blume & Redecker for producing wave-wound radio and television coils. The spools are delivered from a hopper

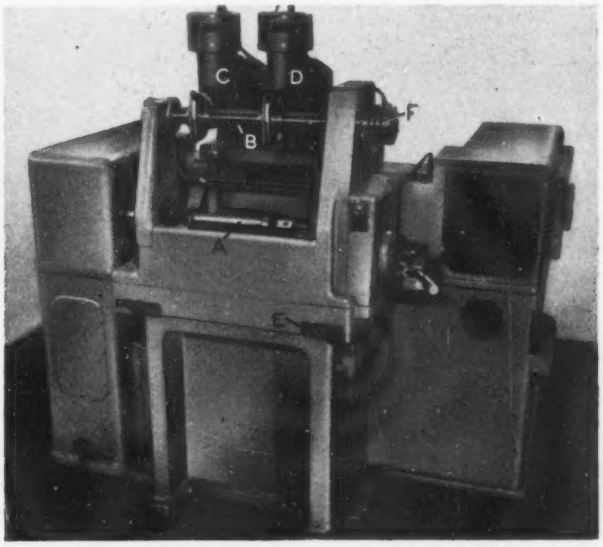

Fig. 9. Dufour profile milling machine for turbine blades

swings a finished coil into a position between a pair of fixed claws at *B*. With the forward movement of the turret slide, the finished coil is stripped from the mandrel and falls into a container, and a fresh spool is engaged with the headstock driving spindle.

Wave-wound coils comprising from 15 to 3,500 turns, and with 1/6 to 4 crossings per revolution, can be produced at either one or two positions on the spool, and upon completion of the winding operation, a wax adhesive is applied automatically to retain the coil turns in position. Wax is contained in a small, electrically-heated pot, under thermostatic control, which is located on the machine bed, immediately below the winding axis, and is applied to the lower surface of the coil by means of a pad on the end of a pivoted arm. The wire from the bobbin is then cut automatically, and the take-on end is

held in a gripper, in readiness for winding the coil on the next spool. A safety switch ensures that the machine cannot be started until the wax reaches the correct temperature. A small exhaust fan is incorporated in the machine base, to remove any fumes from the heated wax.

Steplessly-variable speeds from 200 to 3,000 r.p.m. are provided for the winding head spindle by means of a spring-loaded, friction-disc transmission from the motor. The latter is housed in the machine base, below the headstock, and speed changing is effected by pivoting the motor base to vary the position of the driving disc in relation to the driven disc. A solenoid, coupled to the motor base, automatically reduces the spindle speed at the start and finish of the winding cycle to avoid breakage of the wire, and the slow speed is maintained while the hot wax is being applied. For starting and stopping the spindle there is a solenoid-operated clutch, and provision is made for varying the speed of operation of other functions of the machine, to suit the type of coil being produced.

A safety switch is incorporated whereby the machine is stopped automatically should the wire break. The machine will also stop automatically should a spool fail to be delivered to the turret mandrel, or if the spool is not properly located in the winding position. In the illustration, it may be noted, the discharge channel from the hopper to the transfer arm has been removed.

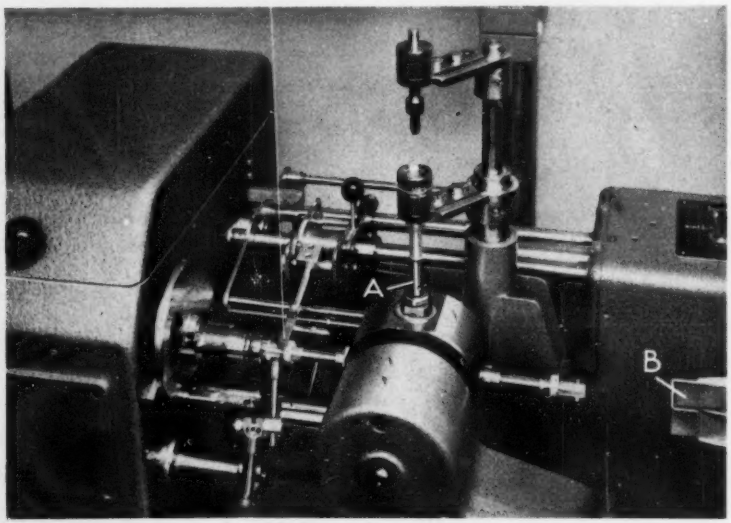

Fig. 11. Close-up view of the turret and winding head on the Blume & Redecker coil winding machine

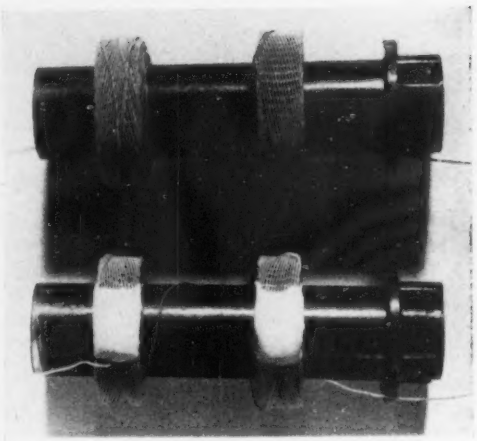

Fig. 12. Examples of wave-wound coils produced on the Blume & Redecker machine

Wave wound coils with two windings of 0·006-in. diameter wire, which were being produced at the exhibition, are shown in Fig. 12, the diameter of the plastics moulded spool being $\frac{5}{16}$ in., and the overall length $1\frac{7}{8}$ in. Spools up to $3\frac{1}{8}$ in. long are accommodated on the machine, and the maximum diameter of coil that can be wound is 2 in. The output obtained is determined largely by the number of turns in the coil and the maximum permissible winding speed, and for the types of coils for which the machine is designed the cycle times range from as little as 8 sec. up to about 40 sec. Change-over from one job to another can be effected in approximately ½ hour, and the feed hopper will hold up to 1,000 spools.

A machine of this type has already been installed in the works of a well-known radio and television firm in this country, and Blume & Redecker, who make a wide range of equipment for coil winding, are now developing fully-automatic machines

for producing other types of coils. It is understood that, in the near future, a high-production machine will be completed for winding the armatures of small electric motors incorporated in dry shavers.

RENAULT TRANSFER MACHINE FOR DIESEL ENGINE CYLINDER HEADS

Régie Nationale des Usines Renault exhibited a number of special-purpose machines incorporating electro-mechanical unit heads, noteworthy among which was the in-line transfer machine, shown in Fig. 13, for carrying out drilling, facing, rough and finish boring, and tapping operations on cast-iron cylinder heads for 2- and 3-cylinder diesel engines. This machine will handle 200 cylinder heads per shift, and is so designed that the change-over from one type to the other can be rapidly made. The platen fixtures are arranged to take both types of head castings, with only a small amount of adjustment, and pre-set tools are employed in the unit heads which can quickly be removed and re-set.

Ten unit heads, ranging in size from 2½ to 16 h.p., are provided on each side of the machine, and between pairs of heads—five on each side—there are air cleaning and gauging stations at which checks are made to ensure that the various operations have been properly performed. Each casting, located by three previously-milled faces, is held by a series of screw-operated clamps, and at certain stations auxiliary supports are applied to take the thrust of the cutting tools. An air-hydraulic system of improved design is incorporated for clamping the platens to the bed.

After the last machining operation, the platen is transferred to a turn-over cleaning station, seen at A in Fig. 13, which ensures that all the swarf is removed, and at the following station the casting is gauged. The platen then moves on to a turntable, whereby it is rotated through 90 deg., and a ram unit on the left pushes it on to a return conveyor arranged alongside the machine, which delivers it to the starting end. Here, the finished casting is removed and the platen is reloaded. With this arrangement, the whole installation can be tended by one operator.

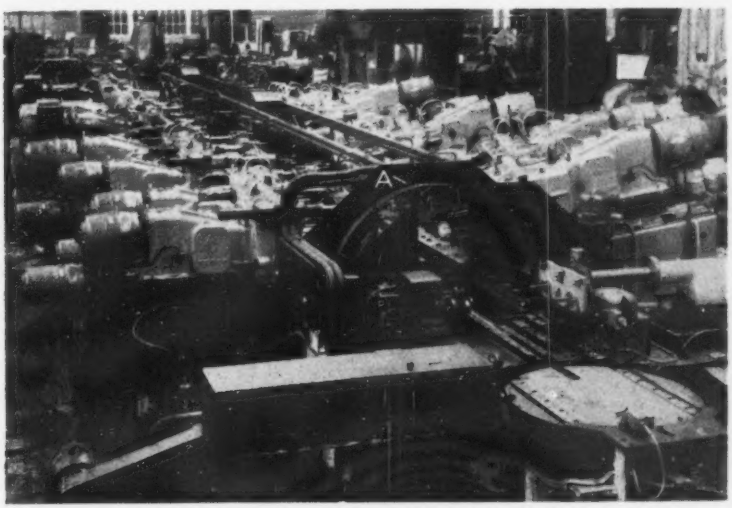

Fig. 13. Renault in-line transfer machine for drilling, facing, boring and tapping operations on cylinder head castings for 2- and 3-cylinder diesel engines

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ELECTRICAL CIRCUITS PRODUCED BY SPUTTERING. It is reported that promising results are being obtained at the Bell Telephone Laboratories, U.S.A., from experiments concerned with the deposition of metal to form electric circuits by the sputtering process. High melting point metals, such as tantalum and titanium, can be laid down in thin films to form resistors, and by suitably masking the circuit board, almost any desired arrangement of lines and patterns can be obtained, and the lines may be very narrow.

In addition to pure metals, alloys such as nickel-copper and nickel-chromium can be deposited by sputtering, and it appears that the original compositions are approximately retained.

It has also been found possible to produce capacitors by a combination of sputtering and chemical methods. A tantalum film is first deposited over an area of the required size and shape, and is then anodically oxidized to provide a tantalum oxide dielectric film. Subsequently, a film of gold, which forms the counter electrode, is evaporated on to the dielectric, to obtain the complete capacitor "sandwich."

Copper leads can readily be deposited, by sputtering, to connect the various components of a circuit, which are said to adhere strongly.

Numation Air-hydraulic Actuator Unit

The electrically-controlled air-hydraulic actuator unit recently developed by Numation, Ltd., The Brackens, London Road, Ascot, Berks, is shown in Fig. 1, built into a pinch valve made by an associated company, Numation Valves, Ltd., Alton, Hants, for use in automatic processing plant for the chemical industry.

With this arrangement, the flow of material through an associated pipe line is controlled by a pinching action applied to a rubber sleeve in the valve. The pinching action is obtained by two anvils which are moved towards and away from each other by the actuator unit, and are connected by two pairs of racks and pinions. In this way, similar movements of the anvils, and consequently equal amounts of deformation of the sleeve on both sides of the centre line, are obtained.

Designated type 2/1000, the actuator unit gives a thrust of 1,000 lb. when it is operated by compressed air at 80 lb. per sq. in. pressure, and provides for movement of the anvils through the full working stroke of 2¼ in. on each side of the centre line, in 1 to 1½ secs. Weighing 25 lb., it has an overall length of 10½ in., and, in cross-section, the body measures 6 by 6 in. The positions of the anvils, which determine the flow of material through the pipe, are closely controlled by solenoid-operated air-valves mounted on top of the body, and normally enclosed by a cover. These solenoid valves may be operated remotely by push buttons, or in conjunction with automatic weighing machines; time or temperature controllers; depth, volume or flow indicators; or sequence or programme control systems. Micro-switches, also mounted on top of the head, can be operated by adjustable stops, as will be later explained, to actuate visual or audible warning systems. Alternatively, these micro-switches can be arranged to operate the solenoid valves for automatically

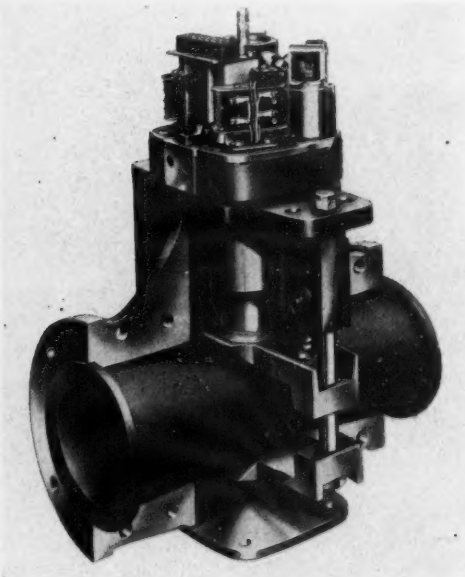

Fig. 1. Cut-away view of a pinch valve incorporating the Numation electrically-controlled air-hydraulic actuator unit

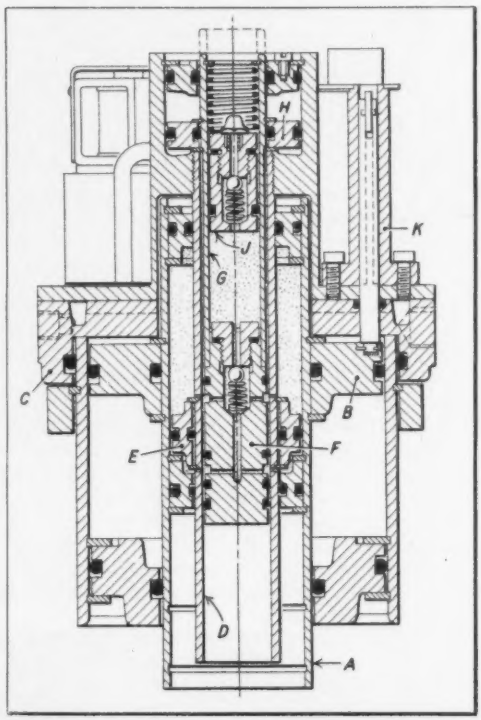

Fig. 2. Sectional view of the Numation air-hydraulic actuator unit

setting the valve anvils in predetermined positions.

Referring to the sectional view of the actuator unit in Fig. 2, the upper anvil is normally secured to the lower end of the tubular piston rod *A* which carries the large-diameter piston *B*. Compressed air for operating the unit is delivered to the upper end of the piston by way of cored passages in the flanged body *C*, and to the lower end, through a pipe (not shown) which passes through the piston. Cored exhaust ports are also provided in the body, so that the use of external piping has been largely avoided. At its upper end, the tube *D* is fixed to the body, and the space between its periphery and the bore of the piston rod *A* is filled with oil. During the movement of the piston *B* in either direction, by compressed air, oil is passed from one end of the fixed ring *E* to the other, by way of cross holes in the tube *D* and passages in the valve *F*. This valve is secured to the sleeve *G*, which carries the piston *H* near its upper end.

For stopping the piston *B* at any pre-determined point of its travel, the valve *F* is moved upwards by compressed air applied to the lower end of the piston *H*. In this way, the cross holes in the tube *D* are closed, so that the passage of oil from one end of the ring *E* to the other is prevented. In consequence, the piston *B* is stopped in opposition to the full thrust applied at one end by compressed air. The close control afforded by this arrangement is such that, when the unit is operated by push buttons, the piston *B* can be moved intermittently in increments as small as 0·02 to 0·03 in.

The bore of the sleeve *G*, between the upper end of the piston *H* and the lower end of the spring-loaded plug *J*, serves as a reservoir for oil. From the reservoir, the oil can pass to the annular space between the piston rod *A* and the tube *D* by way of a spring-loaded non-return ball valve and the passages in the valve *F*. Fluid is delivered to the reservoir by an oil gun through a nipple and a spring-loaded non-return valve in the plug *J*.

Attached to the piston *B* is a rod, which can slide freely in a split sleeve *K* on the body, and the rod has a roller at its upper end. On top of the body there are two arms which can pivot in the horizontal plane and are fitted with vertically-adjustable button-type stops. One of these arms is shown at *L* in the close-up view Fig. 3, and the associated stop may be seen. When the piston *B* (Fig. 2) reaches a pre-determined position, in either direction of its travel, the roller on the rod *K* engages with one of the stops, with the result that the arm on which it is carried is swung outwards to operate a micro-switch. When the micro-switches are set to operate the solenoid valves, this action may cause the piston *B* to be stopped or reversed. If required, the arms *L*, Fig. 3, can be made in two parts, each of which may be fitted with an adjustable stop, and with such an arrangement warning systems as well as the solenoid valves can be operated automatically.

The equipment is expected to find other applications, apart from the operation of pinch valves, and an air-hydraulic feed unit of basically similar design is being developed for use on machine tools. With the latter unit, the passage of oil from one side of the ring *E*, Fig. 2, to the other is controlled by an adjustable needle valve incorporated in the valve *F*, which provides for rapid advance, variable feed, and rapid return of the piston rod *A* in a fully automatic cycle. The electrical system can be arranged to give automatic interlocking of the unit with associated air-operated work fixtures and indexing tables, for instance, and push button control can be provided for "inching" the piston rod. The unit may be applied to a drilling machine, for example, and since the movement of the piston rod can be closely controlled, blind holes may be drilled accurately for depth with an automatic cycle. Because successive feed and rapid traverse movements of the piston rod can be obtained in both directions, the unit may be employed for operating the work table of a milling machine which is set up for pendulum milling.

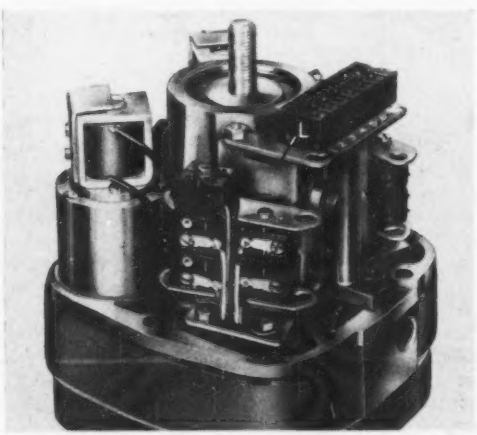

Fig. 3. Close-up view of the unit showing the electrical control equipment

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AIR AND GAS COMPRESSORS AND EXHAUSTERS produced during the second quarter of this year had an average monthly value of £943,000, and units to the average value of £304,000 per month were exported. For the whole of 1957, the corresponding values were £1,125,000 and £439,000.

E.I.A. Eleventh Engineering Display

The Engineering Industries Association recently held their 11th Engineering Display at the Royal Horticultural Society's New Hall, Greycoat Street, London, S.W.1. The opening ceremony was performed by Mr. W. J. Taylor, Parliamentary Secretary to the Ministry of Supply, who afterwards presented prizes for winning entries in the craft competition in connection with the Association's Group Apprenticeship scheme. As on previous occasions, the display was well presented, and of the wide range of engineering products which was on view, attention will here be drawn to some items likely to be of particular interest to readers of MACHINERY.

Fred Ferraris (Clerkenwell), Ltd., Northampton Square, London, E.C.1, exhibited the latest Swiss-built Fehlmann, ½-in. capacity, drilling machine, shown in Fig. 1, and the new Sixis type S-101 universal milling machine (Fig. 2) for which they are the selling agents in this country. Intended for bench mounting, the drilling machine is driven by a ¾-h.p., 2-speed, reversing motor, through a V-belt and expanding pulleys, which give steplessly-variable spindle speeds up to 4,700 r.p.m.

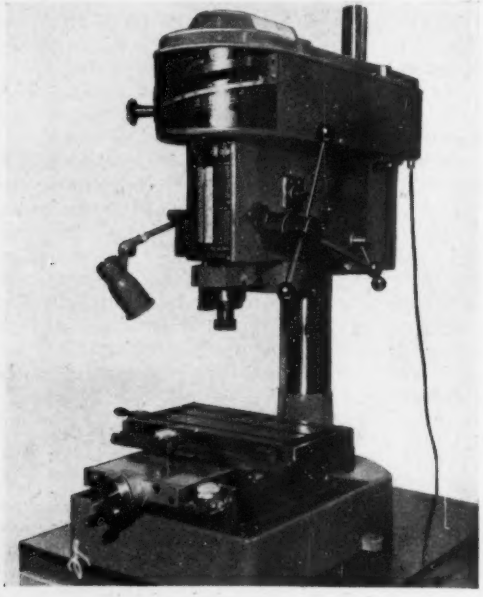


Fig. 1. Fehlmann ½-in. capacity drilling machine

Fig. 2. Sixis type S-101 universal milling machine

Power feed at the rate of 0·0012 in. per rev. is provided on the latest machine to enable boring operations to be carried out. Feed movement is obtained by a leadscrew and half nuts, which are brought into engagement by movement of a lever on the side of the spindle head. The spindle has a travel of 4 in., and the maximum distance obtainable between the nose end and the 16½- by 22½-in. T-slotted base is 18 in. The distance between the machine spindle and the 4-in. diameter column is 8¾ in.

A 15¾- by 8-in. compound work table, with longitudinal and cross travels of 8 and 6 in., can be supplied for mounting on the base, as shown. Light-duty milling operations can then be undertaken, and since co-ordinate settings of the table can be made to an accuracy of 0·001 in., by means of micrometer drums on the traverse screws, centre distances between drilled holes can be held to close limits. In addition, dial indicators are fitted, and provision is made for using length measuring bars for table setting where greater accuracy is required. A boring head and an optical centring unit are available.

Made by the Swiss firm of C. Perrenoud & Fils, the Sixis milling machine can be supplied for

bench mounting or with a cabinet base, as illustrated, and a T-slotted work table, which can be tilted in two directions at right angles, can be fitted. Alternatively, a non-tilting table may be provided. The compound slide which carries the work table provides longitudinal and vertical movements of 5$\frac{29}{32}$ in., and the ram-type spindle head has a cross travel of 3$\frac{13}{16}$ in. on ways on top of the column. Accurate adjustments of the table and spindle head are made by means of precision-ground screws, and micrometer drums are fitted which give readings to 0·001 in. for the longitudinal and cross movements, and to 0·0005 in. for the vertical travel. If required, the nuts, which are of split design, can be released from the traverse screws with the aid of a key, and rapid movements of the table and spindle head can then be obtained by levers.

Drive is taken from a $\frac{1}{3}$-h.p. motor, through a V-belt and stepped pulleys, to a 2-speed gear box mounted on the rear end of the bearing housing for the spindle. Six spindle speeds from 125 to 4,000 r.p.m. are thus provided, the high and low speed ranges being selected by means of a knob on the side of the gear box. The spindle and drive assembly can be quickly removed from the head as a single unit. A swivel bracket can then be attached to the head, to take the spindle unit so that the machine can be used for vertical milling.

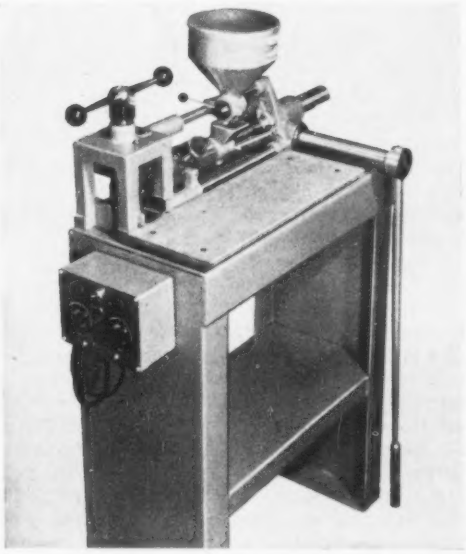


Fig. 3. Manumold hand-operated injection moulding machine

The new, provisionally-patented, Manumold hand-operated injection moulding machine, shown in Fig. 3, which was exhibited by O. Florin, Ltd., 88-90 Holloway Road, London, N.7, will handle ¾ to 1 oz. of polystyrene per shot. Injection plungers of ¾ and 1 in. diameter can be provided, to which pressures up to 12,000 lb. per sq. in. can be applied by a long lever, through a rack and pinion housed in a casting at the right-hand end of the machine. This casting is connected by tie rods to a spheroidal iron casting at the left-hand end, which has an opening at right-angles to the injection cylinder, to take 5-in. long by 2½-in. wide by 3-in. thick moulds, with horizontal parting faces. Clamping forces up to 10,000 lb. may be applied to the mould by a screw made from 90-ton tensile steel, which rotates in a replaceable wire thread insert in the casting, and is fitted with adjustable ball-ended operating handles.

When certain components are being produced, the entire mould is removed from the right-hand casting by hand at the end of the injection cycle. Removal of the upper half, withdrawal of cores, and ejection of the workpieces is then carried out by means of a cam arrangement built into the mould. Alternatively, the upper half of the mould may be attached to either the platen or the screw, and when it has been raised clear, after completion of the moulding cycle, the lower half only is withdrawn from the casting in preparation for removing the components. If required, fixed ejector pins can be provided in the casting for removing the component from the upper half of the mould.

The machine has a capacity for platicisizing 7 lb. of material per hour, and is fitted with two 300-watt heating bands, which provide for a temperature range from 0 to 300 deg. C. A lever-operated dispenser is incorporated in the hopper, for controlling the quantity of plastics material fed to the injection cylinder. If required, a combined hydraulic cylinder and control valve for operating the injection plunger can be readily fitted in place of the casting which houses the rack and pinion for hand working. This cylinder is supplied from a self-contained floor-mounted hydraulic unit, and both injection speed and pressure can be varied as required.

Triometers, Ltd., Ferry Lane, Tythe End, near Staines, Middlesex, displayed the instruments illustrated in Fig. 4, which they have recently developed to provide a convenient means of quickly determining various values of right-angle triangles without the need for calculations. On one side of the instrument, as shown in the upper view, there are vernier scales which are set to correspond with the lengths of the base and perpendicular sides of the triangle. Scales on the

other side of the instrument (lower view) then indicate the length of the hypotenuse, and one angle. Alternatively, settings can be made for angle and the length of one side of the triangle, and readings for the lengths of the other sides are then obtained. The scales give readings to an accuracy of 0·001 in. for the lengths of the sides, and to 5 min. for angle.

On the stand of E. H. Thompson & Son (London), Ltd., 16 Chaucer Road, London, E.7, were shown examples of tools recently introduced by the company for the superfinishing of bores up to 1¼ in. diameter by 8 in. long. The subject of a patent application, the tool incorporates, at the nose end, a number of equally-spaced rollers which can rotate freely, and are housed in slots in the body. These rollers are tapered slightly at their ends, and are set radially in the body, to provide an interference fit with the workpiece bore. Superfinishing of the bore is effected at a single pass of the tool by plastic deformation of the workpiece metal. The tool may be employed on parts made from steel and non-ferrous metals and is stated to enable a surface finish of 2 to 4 microinches to be obtained. Superfinishing may be carried out on bores which have been produced by reaming or core drilling, so that the need for an intermediate grinding operation is avoided. Since either the tool or the workpiece may be rotated during superfinishing, the operation may be performed on a turret lathe or a drilling machine, for instance.

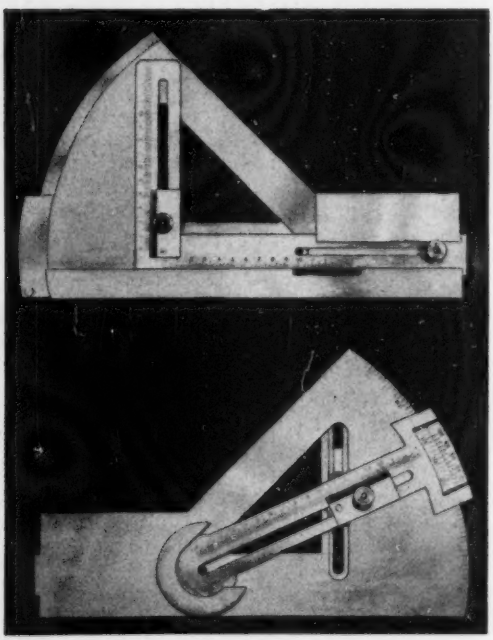


Fig. 4. Instrument introduced by Triometers, Ltd., for resolving right-angle triangles

The exhibits of Lorant & Co., Ltd., 98-100 Croydon Road, London, S.E.20, included a recent addition to the range of portable, motor-driven, high-speed spindle units for grinding and light-duty milling, made by the Precise Products Corporation, Racine, Wisconsin, U.S.A., for whom they are representatives in this country. Designated Super 45, the new unit (Fig. 5) has a nominal rating of ½ h.p., and provides spindle speeds up to 45,000 r.p.m. It is intended for use with tungsten carbide burrs up to ⅜ in. diameter which have 1-in. long cutting edges, and grinding wheels up to 1¼ in. diameter by ⅜ in. wide. The spindle will take collets up to ¼ in. capacity, and a drill chuck can be supplied. Weighing only 3¼ lb., the tool has an overall length of 11 in., and the diameter of the single-piece light alloy body is 2½ in. A bracket is available which enables the tool to be mounted on a lathe cross-slide for example.

A dial indicator instrument known as the Trav-A-Dial, introduced by the M.E. Hodge Corporation, Pasadena, California, U.S.A., for accurately measuring the movements of slides on machines was shown by the sole agents in this country, A. P. Warren, Ltd., Carl Edvard House, Sheen Road, Richmond, Surrey. The instrument is secured to a slide, and a neoprene "O" ring, fitted to a built-in friction drive wheel, is held in contact with a machined surface on a fixed part of the machine by spring pressure. When the slide is traversed on its guideways, two pointers on the dial indicator are rotated by the action of the friction wheel. The scale associated with the fairly long, centrally-mounted, pointer gives readings to 0·001 in., and the second scale indicates movements of the slide up to 1 in., and is divided into tenths. There is a separate circular scale which gives readings in inches for slide travels up to 6 in. This scale—and with it the friction wheel and both pointers on the dial indicator—can be rotated freely by a knob for zero setting. In addition, the scale for the first pointer can be turned by hand so that the instrument can be set accurately for zero. The body which carries the dial indicator can be moved on dovetail guideways in the base by means of a small lever. In this way, the friction drive wheel can be brought clear of the contact face on the machine, to disengage the instrument.

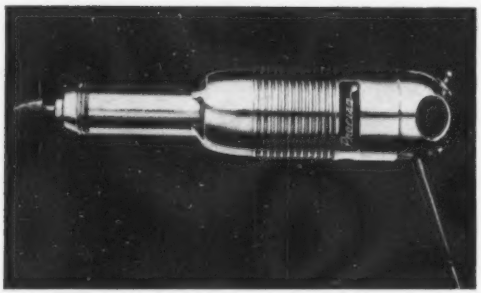


Fig. 5. Precise Super 45 portable motor-driven spindle unit

Newman & Guardia, Ltd., South Road, Temple Fields, Harlow, Essex, exhibited their latest Newgar air-operated indexing machine for automatically inserting brass tags into electrical components such as valve bases and turret tuners for television receivers. The machine on view, details of which will be given in a forthcoming issue of MACHINERY, was set up for inserting six tags simultaneously into a panel for a turret tuner, and has an operating speed of 80 cycles per min.

In Fig. 6 is shown the recently-introduced Cat tool grinder which was displayed by Motor Repairers & Spares, Ltd., 76 Stoke Newington High Street, London, N.16. Three ring-shaped grinding wheels of different grades are mounted concentrically and bonded to each other, and the assembly is secured to a recessed metal back plate, which is attached to the motor-driven spindle. The wheel has internal and external diameters of 4 and 8 in., and a useful feature of this patented arrangement is that rough, semi-finish, and finish grinding can be carried out by merely bringing the tool to be sharpened into contact with different portions of the composite wheel face. In addition, the bore of the wheel can be employed for grinding arcuate clearances on boring tools.

Of approximately semi-circular shape, the table is fitted with a stop for the tool to be ground, which can be swivelled in the plane of the top surface through angles up to 95 deg. in each direction. The table can be tilted for grinding cutting tools with positive rakes up to 20 deg. and negative rakes up to 7 deg., by rotation of a knob, and accurate settings can be made with the aid of a pointer and a 15-in. diameter scale mounted at the rear of the base. A light-alloy tubular column, which carries the table, is pivoted at its lower end, and is supported by flexible steel strips housed in the base, so that friction-free movement towards and away from the grinding wheel is obtained. This assembly can be adjusted vertically by a handwheel on the side of the base.

W. Pinder & Son, Ltd., King Street, Peterborough, displayed a selection of their Versatool cabinets, of sheet metal construction, which are now available in a wide range of sizes and types. The latest type D cabinets, which were on view, are fitted with sliding doors, and can be supplied with as many as 22 pivoted trays for storing, for example, measuring instruments, spanners, cutting tools, and equipment for machine tools. Alternatively, the cabinets can be provided with two or four drawers and 20 or 18 trays. As was explained in MACHINERY, 89/978—26/10/56, the trays, which will take loads weighing up to 1 cwt., can be pivoted at either end for easy removal from the cabinet, and are adjustable for height.

The No. 1 reflex projector made by J. E. Baty & Co., Ltd., Burgess Hill, Sussex (see MACHINERY, 89/43—6/7/56) was shown fitted with a new work table incorporating micrometer adjustment, as illustrated in Fig. 7. Mounted on ball-bearing guideways to ensure smooth movements, the table has a longitudinal traverse of 2 in. and a cross traverse of 1½ in. Settings are made by drum-type micrometer heads which give readings to 0·0001 in., and provision is made for using slip gauges to obtain table adjustments exceeding 1 in.

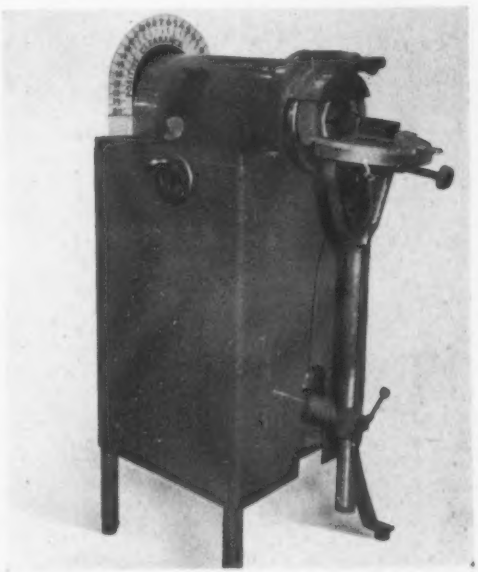


Fig. 6. Cat tool grinder with composite wheel

Among the exhibits of Aylesbury Turned Parts (True Screws), Ltd., Brittania Street, Aylesbury, Bucks, may be mentioned a recent addition to the German-made Helios range of vernier calipers. The sliding jaw of the new caliper incorporates a V-shaped slot, which enables stepped cylindrical parts to be readily checked for length, and facilitates the measurement of pieces of other shapes when the faces to be checked are not in line.

Equipment displayed by Lorant Engineers (London), Ltd., 65 High Street, South Norwood, London, S.E.25, included the Drillspeeder unit shown in Fig. 8 which is made by the Jarvis Corporation, Middletown, Connecticut, U.S.A., and handled by the company in this country. This unit can be supplied with taper and parallel shanks of different sizes for attachment to the spindles of drilling machines, and incorporates spur gearing which gives an increase of spindle speed in the ratio of 4 to 1. It is intended to provide a maximum spindle speed of 30,000 r.p.m., and is fitted with a $\frac{5}{32}$-in. capacity drill chuck. When the unit is in operation it is prevented from rotating with the spindle of the drilling machine by a torque arm.

Among other companies exhibiting works equipment were:—Ablex Tools, Ltd. (electrodes for spark erosion); Addison Tool Co., Ltd. (metal sawing machines, abrasive belt grinders and air-operated presses); Addy Products, Ltd. (standardized jig and fixture parts); F. Brauer, Ltd. (toggle clamps and holding devices); A. Capp & Son, Ltd. (dial indicator measuring equipment); Crawford Collets, Ltd. (collets and feed fingers); A. Douglas & Co., Ltd. (small-capacity lathes and machine shop equipment); David Dowling, Ltd. (engraving machines); Duplex Electric Tools Ltd. (portable tools and flexible shaft equipment); Hancock & Co. (Engineers), Ltd. (flame cutting equipment); Thomas P. Headland, Ltd. (small tools); J. Hornal (universal milling attachment); H. S. S., Ltd. (small tools); Hunton, Ltd. (universal bolster sets); Kasenit, Ltd. (heat treatment furnaces, pyrometers, and case-hardening compounds); Lennie & Thorn, Ltd. (grinding fixture); W. H. Marley & Co., Ltd. (broaches and machine shop equipment); Martindale Electric Co., Ltd. (electrical and factory maintenance equipment); Meritus (Barnet), Ltd. (spot and butt welders); J. B. Purefoy Unit Tooling, Ltd. (standardized jig and fixture parts); Tartan Manufacturing Co., Ltd. (portable electric tools); Lensometer, Ltd. (physical testing equipment); Watson, Manasty & Co., Ltd. (optical projectors); and West London Optical & Tool Co., Ltd. (optical projectors).

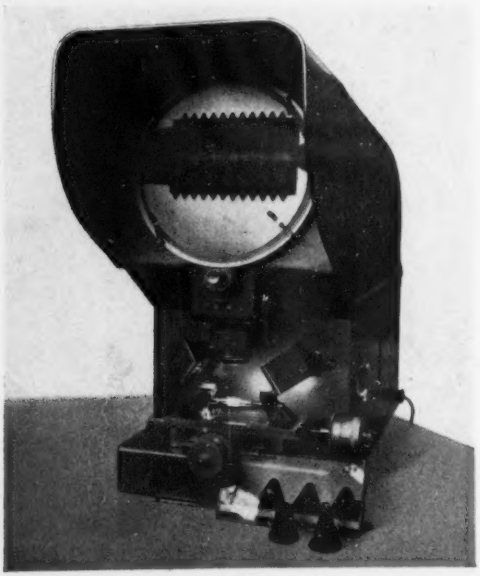


Fig. 7. Baty No. 1 reflex projector fitted with the new work table

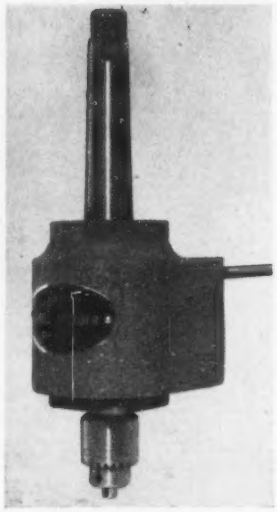


Fig. 8. Jarvis Drillspeeder speed increasing unit for drilling machines

NEW PERMACEL PAPER MASKING TAPE—Johnson & Johnson (Great Britain), Ltd., Bath Road, Slough, Bucks, have introduced a new general purpose paper masking tape for all forms of spray-painting work. Known as Permacel 93, the tape has exceptionally thin backing material, which reduces paint build-up, and it is claimed to be particularly suitable for use on work where fine lines of demarcation are required.

Machine Tool Demonstration

The Mortimer Engineering Co., and Stanhope Machine Tool Co., Ltd., recently staged joint demonstrations at their showrooms at 202-206 Acton Lane, London, N.W.10, of some of the Continental-built machines for which they are the distributors in this country.

The principal exhibit of the former company was the German-built Ravensburg type KH 55 hydraulic profiling and facing lathe, full details of which were published in MACHINERY, 91/1034—1/11/57. This lathe will swing a maximum diameter of 51 in. over the bedways, and distances up to 31½ in. are obtainable between the faceplate and the carriage. It incorporates the Unicop electro-hydraulic system, which is employed for normal sliding and surfacing as well as profiling operations, mechanical feeds having been entirely eliminated.

A useful feature of the Unicop system is that it enables a series of "slicing" motions to be applied automatically to the saddle when an annular groove is to be produced in the face of the work, from the solid, by the copying technique. When this operation is to be performed, a push button on the pendant type control panel is depressed at the required point in the copying cycle. Thereupon, the stylus pin on the tracer head is traversed, in space, across the slot in the template which corresponds to the cross-sectional shape of the groove to be produced in the work. At the same time, a similar movement is applied to the carriage so that a facing cut is taken on the work.

When the stylus pin makes contact with one side of the slot, it is caused to dwell for a pre-set period which is controlled by a timer on the pendant unit, while the tool slide is advanced towards the work to apply a fresh facing cut. Since the stylus pin is in contact with the template at this stage, adjustment of the carriage is effected automatically by the electro-hydraulic system, for producing a slot with inclined sides for instance. At the end of the dwell period the stylus pin is again traversed in space across the slot in the opposite direction, and this sequence of operations is repeated until the groove has been cut to its full depth.

On the Abene (Swedish) type VHF-2B milling machine, which was available for demonstration, the cutter head may be tilted through 135 deg. so that the same unit can be used for horizontal, angle, and vertical milling. The cutter head and cylindrical overarm are mounted on a casting, which incorporates the spindle drive mechanism and can be adjusted on inclined ways on top of the column. When the head is set for horizontal milling, it is secured to the top of the column by a lever-operated clamp, to provide a rigid assembly. Twelve spindle speeds, from 50 to 1,300 r.p.m., are available, and 12 longitudinal feeds, from ¼ to 15 in. per min., can be applied to the 40- by 10½-in. table, which has a maximum travel of 22 in. Cross movement of the table and vertical adjustment of the knee, through a distance of 8 in., are obtained by hand.

Other Swedish-built machines which were shown included the Koping type VF2A vertical milling machines, Arbogo radial and pillar-type drilling machines, the latter in single- and multi-spindle designs, and a Thule type TPH 1000, 40- by 8-in. hydraulic surface grinder.

A noteworthy feature of the type RESH 450/200 hydraulic cylindrical grinder built by the German firm of Carstens, is that the wheel-head is mounted between centres and is tilted forwards automatically at either one or both ends of the table travel by a cam driven by a hydraulic motor, for applying fine feeds to the work. In addition, a Fromag (German) type KZE 90/650 keyseating machine, which has a capacity for cutting keyways from ¼ to 3½ in. wide, in bores from ½ to 19¾ in. diameter, was shown in operation.

Prominent among the exhibits of Stanhope Machine Tools, Ltd., were the type 1n and type 27R heavy-duty universal milling machines built by the French firm of Gambin. These machines incorporate the company's well-establish design of swivelling spindle head, whereby an exceptionally wide choice of settings is provided. The spindle head is trunnion mounted in a circular ram, which can be rotated and moved axially in the column.

The 44- by 11¼-in. table of the type 1n machine has a longitudinal travel of 23⅝ in. and a cross movement of 10¼ in., and a vertical traverse of 17¾ in. is provided for the knee. There are 18 spindle speeds ranging from 40 to 2,800 r.p.m., and 12 power feeds from 0·3 to 25 in. per min. longitudinally and transversely, and from 0·15 to 12½ in. per min. vertically.

The type 27R milling machine has a 59- by 12¾-in. table, and traverses of 39⅜ in. longitudinally, 12⅝ in. transversely and 25⅝ in. vertically are obtainable. Optical equipment for longitudinal and transverse setting of the table is fitted on the larger machine, and can be supplied, if required, on the type 1n.

Also of interest was the French-made G.S.P.

co-ordinate setting table which can be employed on a radial drilling machine, for example, to enable operations such as drilling, boring and facing to be carried out on workpieces on a production basis without the need for jigs. The 39½- by 31½-in. work table has maximum travels of 31⅝ in. longitudinally and 22 in. transversely, and is traversed, in both directions simultaneously if required, by motor driven screws. Settings can be made with the aid of graduated drums associated with the traverse screws, or automatically by means of adjustable stops which are mounted on indexing holders, and are pre-set by means of length measuring bars.

The company is the sole agent for the Ainjest screwcutting attachment for centre lathes, made by Saunderson & Costin, Ltd., Highclere, near Newbury, Berks. This attachment can now be supplied in a variety of designs, several of which were exhibited, for fitting to the aprons of centre lathes by different British makers.

Production Engineers Dinner

The annual dinner of the Institution of Production Engineers was held at the Dorchester Hotel, London, W.1, on October 29. As usual, there was a good attendance, and some 500 members and guests were present on this occasion. The Chair was taken by The Rt. Hon. The Earl of Halsbury, President of the Institution, who, after the Loyal Toast had been honoured, proposed "Our Guests," coupled with the name of the Principal Guest, Sir William Black, Chairman of the National Research Development Corporation.

Lord Halsbury gave a brief review of the activities of the Institution during the preceding year, and pointed out that the most important event during that period had been the finalization of the new examination scheme. Another significant development had been the publication of the report by the Research Committee on Quality in Production, which was completed last June. Turning to the forthcoming year, he stated that it had been decided to carry out an investigation into the organization and methods at the Institution headquarters, with a view to improving efficiency.

Continuing, he referred to his visits throughout the country in his capacity as president of the Institution, and said that he had been very impressed by the standard of efficiency achieved in many plants. He considered that these were some of the better plants, however, and that efforts should be made to raise the average standard to this level. Nevertheless, he felt that was not an Institution responsibility, the main task of which was further to improve the standard of the best. In closing, he drew attention to the slowness with which electro-mechanical machine control systems had been applied in this country. Although we were often quick to develop new ideas, we were frequently, he feared, slow in exploiting new developments, and he appealed for a stronger pioneering spirit on the part of machine users, which would act as a spur to the builders of manufacturing equipment.

Lord Halsbury then introduced Sir William Black, and briefly outlined his distinguished career. In his reply, Sir William drew attention to the work of the National Research Development Corporation, and pointed out that one of its functions—not perhaps generally appreciated—was to provide a source of risk capital. It should not be thought that the corporation operated as a charitable institution, however, and any arrangements that were made with an inventor were on a sound business footing, and a good return on any investment was expected.

Engineering was setting the pace of civilization, he continued, although whether the ultimate results would be for good or ill could not be foreseen. He felt that no production engineer could be backward in outlook, and considered that the Institution was in the van of progress. We had no choice but to continue as an industrial and trading nation, he stated, and the best young brains of the country should be applied to science and industry. The Institution of Production Engineers had done much to encourage young engineers, but he felt that many scholastic institutions tended to direct particularly able young men towards other professions, to the detriment of our engineering industries.

Concluding, Sir William said that he had one major criticism to make, namely, that the cost of tooling up a new project continued to rise, and was now the most important item in an industrial budget. If pre-production costs rose much further, he felt that design was in danger of becoming increasingly inflexible, a condition that we could ill afford in view of the competition that we must face in world markets.

At the invitation of the President, Sir William Black then made various presentations on behalf of the Institution. The award for the "George

Bray Memorial Lecture, 1957," was made to Dr. V. E. Yarsley, for his paper entitled "The Fabrication of Plastics"; for the "Viscount Nuffield Paper, 1957," to The Rt. Hon. The Lord Hives, C.H., M.B.E.—"Technical Education for Production Engineers"; and for the "E. W. Hancock Paper, 1958," to Mr. Lewis T. Wright—"Human Relations in Industry—Men, Women and Work." Unfortunately, Dr. H. Barrell, author of the "Sir Alfred Herbert Paper, 1957," and Mr. Boyd K. Bucey, author of the "Lord Sempill Paper, 1958," were unable to be present. Institution medals were presented to Mr. J. A. Grainger, for the best paper given by a member during the year 1956-7, which was entitled "New Techniques in Sheet Metal Forming," and to Mr. A. G. Thompson, for the best paper presented by a non-member during the year 1956-7—"Measuring and Forecasting Cost Data in Highly Variable Production." "The Schofield Travel Scholarship, 1957," was presented to Mr. J. D. Parson, and the "Lord Austin Prize, 1957," for the best essay by a graduate of the Institution, to Mr. J. F. Percival—"Education for Technology and Management."

Following these presentations, Mr. H. E. Honer, an honorary member and founder of the Institution, presented to the President, for safe keeping on behalf of the members, a bound volume of documents relating to the initiation of the Institution. In a brief address, Mr. Honer recalled the original meeting at the Cannon Street Hotel, on February 26, 1921, when the decision to form the Institution was taken, and drew attention to the growth in size and status that had taken place in less than 40 years. On behalf of the Institution, Lord Halsbury thanked Mr. Honer for his gift, for his generosity in having the documents bound so handsomely, and for safeguarding the documents for so many years.

Finally, Mr. H. W. Bowen, O.B.E., Chairman of Council, thanked Sir William Black for attending the dinner, for his speech, and for presenting the awards, and concluded by paying a further tribute to Mr. Honer, who made a brief speech in reply.

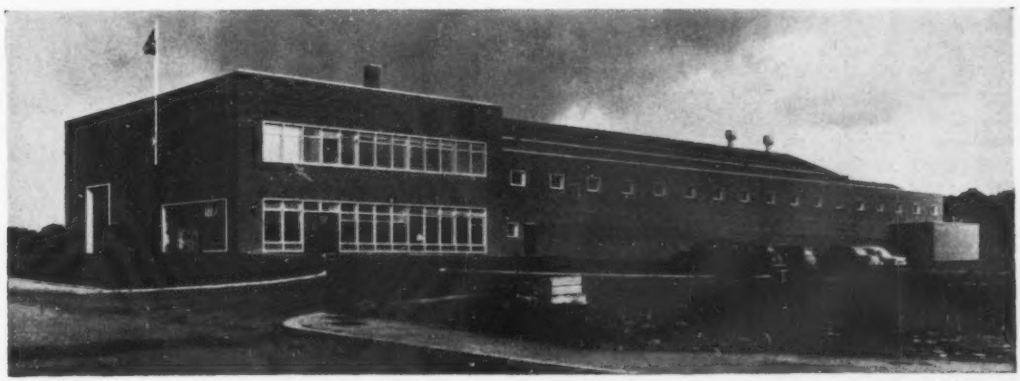
Cincinnati Shaper Factory

The Cincinnati Shaper Co., Ltd., a wholly-owned British subsidiary of the Cincinnati Shaper Co., Cincinnati, Ohio, U.S.A., recently occupied their new factory in Peel Park Place, East Kilbride, Glasgow. The works are laid out for the production of press brakes and guillotine shears, and the equipment installed, and the manufacturing techniques to be employed, will enable high standards of efficiency to be achieved. Provision has been made for extension of the plant as the volume of business increases.

Initially, ¼-in. capacity guillotine shears and 90- and 150-ton press brakes will be built, but activities will later be extended to cover the complete range of Cincinnati guillotine shears up to 1½-in. capacity and press brakes up to 1,400 tons.

The parent company was founded in 1898 to manufacture metal shaping machines, and the first Cincinnati all-steel press brake was introduced in 1922.

Mr. David H. March, vice president and director of the American firm, is managing director of the British company, which is stated to be the first subsidiary of a United States machine tool builder to be established in Scotland.



The new factory of the Cincinnati Shaper Co., Ltd., at East Kilbride, Glasgow

News of the Industry

Manchester and District

KENDALL & GENT, LTD., Gorton, are fully employed with the production of plano-milling, vertical milling, screwing, and broaching machines. Plano-millers in progress include both double-standard and openside-type machines of various capacities. We noted a double-standard machine with two vertical-spindle and two horizontal-spindle milling heads, with a capacity of 18 by 11 by 11 ft., and weighing approximately 150 tons, which has just been completed for the British Thomson-Houston Co., Ltd., Rugby, also an open-side plano-mill, under test, with one vertical-spindle and one horizontal-spindle head and a milling capacity of 10 by 3 by 3½ ft., which is destined for the Steel Company of Wales, Ltd. The latter machine is fitted with Hilger & Watts measuring equipment. Our attention was also drawn to the 37½- by 12- by 9½-ft. plano-milling machine which is being built for C. A. Parsons & Co., Ltd., Newcastle-on-Tyne, and is expected to be under test at the end of the year. This machine has four 100-h.p. milling heads and will weigh approximately 400 tons.

Orders are also in hand for screwing machines of both the single- and duplex-types, of various capacities, and for broaching machines. In addition to the range of CVM 25, 40 and 60 vertical milling machines, we noted a machine of smaller capacity, known as the CVM 15, which has recently been introduced. On the new machine, the distance from the centre of the spindle to the column face is 18 in., and the height admitted between the spindle nose and the table ranges from 1½ to 24 in. The table has a working surface of 54 by 16 in., and longitudinal and cross traverses of 44 and 18 in. There are 18 spindle speeds in three optional ranges, and 16 mechanical feeds in four optional ranges, also rapid power traverses. The spindle is driven by a 10 h.p. motor. At a later date, we hope to describe the machine more fully.

A steadily-maintained demand is reported for screwing dies and inserted-blade spiral milling cutters. New commercial offices and reception rooms are in course of erection at these works. A new catalogue has recently been issued, in which the firm's latest type plano-milling machines are described and illustrated.

BRAYSHAW FURNACES, LTD., Belle Vue, have orders in hand for a wide variety of gas, oil and electric furnaces. Among the larger furnaces in progress are three full recirculation, bogie-hearth types, two of which, with load capacities of 150 and 250 tons, the latter having a length of 50 ft., are destined for William Beardmore & Co., Ltd., Glasgow. The third furnace, of 250-ton capacity by 45 ft. long, is for Thomas Firth & John Brown, Ltd., Sheffield. These furnaces have a temperature range from 150 to 950 deg. C. In the works we noted controlled atmosphere, pusher-type furnaces, of 2- and 4-tube types, and gas-fired shaker-hearth heat-treatment furnaces in progress, in addition to the standard high-speed steel hardening and tempering furnaces, salt baths, and lead melting furnaces.

To provide for speedier repairs and servicing of all makes and types of furnaces, the company has recently established a repair and service depot at Northfield Road, Rotherham, to meet the needs of furnace users in the Sheffield district. One of the firm's small natural draught gas-fired Hynor oven furnaces is to be demonstrated at an exhibition organized by the National Trades Technical Societies, which will be held at Edmund Road Drill Hall, Sheffield, from November 12 to 15. This heat-treatment furnace has a maximum operating temperature of 1,200 deg. C., and is designed for accurate control and uniform heat distribution. New commercial and drawing offices, and reception rooms have recently been occupied at the Belle Vue works.

BRAYSHAW TOOLS, LTD., Belle Vue, report a steady demand for both standard and special milling cutters, including inserted-blade and large-size cutters. Much development and research work is in hand, and cutters have recently been supplied for machining Nimonic alloys.

HERBERT HUNT & SONS, LTD., Old Trafford, are fully occupied with the production of their range of twist drill sharpening machines for drills from ¼ to 4 in. diameter. A new design of twist drill point sharpening and thinning machine has recently been developed, to which we hope to make further reference in due course. Other orders cover twist drill manufacturing machines for flute milling, also clearance milling and grinding, and triple-head tap fluting machines and tap shank squaring machines. In addition, we may note orders for surface grinding machines, tool and

cutter grinding machines, and for the latest designs of Pearns tapping attachments and accessories. Export orders have recently been received from Italy, India, South Africa, and the U.S.A.

CRAVEN BROTHERS (MANCHESTER), LTD., Reddish, Stockport, have developed a bevel gear lapping and running-in machine for improving the running performance of straight or spiral bevel gears before they are finally assembled. Pairs of bevel gears, ranging from 3 to 14 in. diameter, can be run together under pressure, initially with a suitable lapping compound, and later under a cascade flow of lubricating oil only. While basically designed for bevel gears with 90 deg. shaft angles, the machine has a swivel adjustment to enable gears with shaft angles of 75 to 105 deg. to be handled. This swivel motion also permits the application of greater pressure to either the tips or roots of the gear teeth during the running-in operation, in order to obtain more central bedding of the teeth when the gears are finally mounted at their correct shaft angles.

LEYLAND MOTORS, LTD., Leyland, have increased the exports of passenger vehicle chassis during the first nine months of this year by 33 per cent as compared with the corresponding period of last year. This increase has been largely attributable to the demand for Leyland Worldmaster underfloor-engined buses, which are being used in more than 20 countries.

H. B.

London and the South

BEARD & FITCH, LTD., 60 Britton Street, Clerkenwell Road, E.C.1, are experiencing a good demand for a wide variety of gears, many of which are required for instruments and for motor-vehicle transmission systems. New machine tools are regularly being purchased to augment the production equipment, and recent additions have included Heidenreich & Harbeck bevel gear generators, a Zuffenhausen thread milling machine, and a Dean, Smith & Grace 13-in. swing centre lathe. Among machines on order may be mentioned two Mikron gear hobbers.

DESIGNS & INSTALLATIONS, LTD., Walnut Tree Close, Guildford, Surrey, who joined the Southern Areas Electric Corporation last November, specialize in the design and construction of packaging plant, and their latest machines enable effective use to be made of a wide range of new wrapping materials. Machines for applying screw caps to bottles and other containers are also produced. The company is active in both the home and export markets, and the latter, it is reported, offers good possibilities for increased trade.

In addition, facilities are available for toolmaking and the production of moulds for the plastics industry. In this connection, it may be noted that the company is maintaining connections with the aircraft industry, to which large numbers of jigs and fixtures and much special tooling have been supplied during recent years.

A. W. INSTRUMENTS (GUILDFORD), LTD., 2 Walnut Tree Close, Guildford, Surrey, are engaged in the production of mercury-in-steel thermometers, pressure-operated electrical switches, and other instruments for indicating pressures and temperatures. One type of pressure cut-out, incorporating a mercury switch rated at 10 amp., is regularly supplied to makers of industrial refrigerating plant, for operation at pressures up to 250 lb. per sq. in. Instruments of this type, fitted with resetting buttons, can be supplied for other pressures, as required.

F. W. H.

A Second Language

(*Continued from page* 1035)

Translations of Russian technical literature that have been made available in this country have indicated that much of the work that is being done by Soviet engineers is of considerable importance, and this work is likely to increase in volume, range and significance as the expansion of Russian industry proceeds. Although the choice of a second language must obviously be influenced by the field of activity of each individual engineer, there appears to be a growing need for more engineers with a working knowledge of Russian, to supplement those who are already capable of reading technical articles published in German, French, or another foreign language.

Every encouragement should be given by those in charge of engineering institutions, manufacturing organizations and training establishments to engineers—and especially young engineers—who are prepared to make the necessary effort. No foreign language can be learnt without hard work, practice and perseverence, and the study of Russian is made more arduous by the need to master a new and larger alphabet. Once this difficulty has been overcome, however, it will be found that many Russian technical terms bear a close phonetic resemblance to those of English and other languages, so that the task is not as great as might appear at first sight, and there is little doubt that the rewards for the efforts that are made will steadily increase.

Industrial Notes

FACILITIES IN WHITBY, ONTARIO.—A brochure drawing attention to the facilities for industry available in Whitby, Ontario, Canada, has been issued by the Whitby Industrial Commission, Library Building.

BRITISH ROPES, LTD., Doncaster, are manufacturing a wire rope, 1,656 ft. long, with a circumference of 13½ in., for a Hong Kong dockyard. The rope will weigh 25¼ tons.

HELLERMANN, LTD., Crawley, Sussex, have been appointed sole agents in Great Britain for Suprafix spring-loaded terminal blocks made by Wago-Klemmenwerk G.m.b.H.

AT THE 1958 CYCLE AND MOTOR CYCLE SHOW, which will be held at Earl's Court, London, from November 15 to 22, there will be 183 exhibitors, and the stands will occupy an area of 200,000 sq. ft.

WICKMAN, LTD., P.O. Box No. 44, Banner Lane, Tile Hill, Coventry, inform us that with a view to furthering their exports to, and expanding their tungsten carbide interests in Brazil, they have acquired the majority holding in Brasmac Industria e Comercio S/A, Sao Paulo.

ACROW DEMAG CRANES.—In the advertisement for Acrow (Engineers), Ltd., South Wharf, London, W.2, which appears on p. 117 of this issue of MACHINERY, it should have been stated that the company are sole United Kingdom agents for Demag-Zug, Germany.

THE SCOTTISH INDUSTRIES EXHIBITION will be held next year in the Kelvin Hall, Glasgow, from September 3 to 19. The general manager of the exhibition will be Mr. Matthew Donaldson, who acted in this capacity for two previous exhibitions, in 1949 and 1954.

W. C. HERAEUS G.M.B.H., Hanau, West Germany, inform us that all enquiries from Great Britain regarding their high vacuum equipment should be addressed, as hitherto, to Fleischmann (London), Ltd., Chancery House, Chancery Lane, London, W.C.2, who are their sole agents in the United Kingdom.

THE AMBER CHEMICAL CO., LTD., 11a Albemarle Street, London, W.1, announce that, in the near future, their fuel additive Amber SSR 509, which was introduced to the market a year ago, will be wholly manufactured in this country instead of being imported. Regular continuity of supply and quality will thus be ensured.

THE FIRE PROTECTION ASSOCIATION, 15 Queen Street, London, E.C.4, has issued technical information sheets No. 3009 and 3010 on the subject of flammable vapours, gases, and dusts in industry. The first is concerned with explosions and their prevention or control, and the second with ventilation.

PRODUCTION OF PASSENGER CARS (including taxis) during the first nine months of this year totalled 782,996 as compared with 860,842 in the full year 1957, 707,594 in 1956, and 897,560 in 1955. Exports of cars from January to September amounted to 374,499, as against 426,272 in the full year 1957, 335,832 in 1956, and 390,533 in 1955.

STAFFORD TOOL & DIE CO., LTD., is the title of a new company which has been formed to produce machines and tools for the plastics, rubber and engineering industries. A factory and offices have been established at Rowley Street, Stafford (telephone number Stafford 2442), where a variety of general-purpose machine tools, also welding and heat treatment equipment, have been installed.

FIRE PREVENTION IN FACTORIES is the subject of leaflet No. F1442 which has been issued recently by H.M. Factory Inspectorate, Ministry of Labour and National Service, 19 St. James's Square, London, S.W.1. The leaflet is divided into four sections, concerned with measures to prevent the outbreak of fire; combustible materials; preventing fires from spreading; and fire extinguishing.

A RANGE OF DETACHABLE RE-USABLE COUPLINGS for use with flexible pipes has recently been introduced by the Industrial Wire Braid Department, Dunlop Hose Division, St. George's Road, Coventry. The couplings are intended for use with hose rated at between 1,000 and 5,000 lb. per sq. in. working pressure, and will enable users to make up hose assemblies to the required lengths on their own premises.

THOMAS MERCER, LTD., Eywood Road, St. Albans, will display and demonstrate their range of inspection equipment and scientific instruments at the Birmingham Engineering Centre, Stephenson Place, from November 17 to 22. Items on view will include the latest dial and air gauging, also machine control equipment. In addition, there will be time and recording mechanisms and Nilos grease retaining rings.

THE 11TH TECHNICAL EXHIBITION, organized by the London section of the Oil and Colour Chemists' Association, Memorial Hall, Farringdon Street, London, E.C.4, will be held at the Royal Horticultural Society's New Hall, Greycoat and Elverton Streets, S.W.1, from March 17 to 19, 1959. The latest developments in techniques, equipment, and materials for providing surface coatings will be displayed.

THE 1959 CORROSION EXHIBITION will be held at the Royal Horticultural Society's New Hall, Westminster, from April 27 to 30, 1959. An extensive range of anti-corrosion products and equipment will be on view including anti-corrosion fluids; corrosion-resistant metals; de-rusting tools; epoxy resins; finishing processes; and metal spraying equipment. Enquiries should be addressed to The Exhibition Organizer, Corrosion Technology, Leonard Hill House, Eden Street, London, N.W.1.

POSTAL MECHANIZATION is the subject of an interesting brochure which has been issued by the Public Relations Department of the G.P.O., Headquarters Building, St. Martin's-le-Grand, London, E.C.1. There are three main sections entitled: where the money goes, mechanization today, and mechanization tomorrow. The latter section includes a diagrammatic layout of the possible "sorting office of the future," and the possibilities of "public coding" as an aid to automatic sorting are discussed.

FILM ON STEAM AND STEAM GENERATION.—An Instructional colour film on the subject of steam and steam genera-

tion has been produced for International Combustion, Ltd., by Film House Productions, Ltd., as " a contribution to the present campaign to train more technologists." This film, which has a running time of 31 min., is distributed by the G.B. Film Library, Aintree Road, Perivale, Greenford, Middlesex. It is available on loan without hire charge, and the carriage and insurance costs are small.

FARADAY LECTURE, 1958/59.—The subject of the next Faraday Lecture will be " automation," and it will be presented by Dr. H. A. Thomas, M.Sc., M.I.E.E., at the Royal Festival Hall, on Jan. 26, at 6 p.m. Dr. Thomas is manager of the Instrumentation and Control Section of the Engineering Department of Unilever. Applications for free tickets of admission should be sent, during December, to the Institution of Electrical Engineers, Savoy Place, London, W.C.2. Stamped and addressed envelopes should be enclosed.

NICKEL EXHIBITION.—The properties and uses of nickel, nickel alloys and related materials, will be the theme of a 4-day exhibition which will open at the College of Aeronautics, Cranfield, on November 18. The exhibition will be staged by The Mond Nickel Co., Ltd., Thames House, Millbank, London, S.W.1, from whom invitations may be obtained. It will be open to all industrial and commercial organizations in the area, and is intended to provide information for engineers, designers, metallurgists and students, on the latest developments in this field.

AMERICAN STANDARD FOR DIAMOND DRESSING TOOLS.—A standard covering classification, designation, definition, and shank dimension tolerances for diamond tools for dressing grinding wheels has been prepared by The American Society of Tool Engineers, 10700 Puritan, Detroit 38, Mich., U.S.A., as a result of six years' co-operation with the Industrial Diamond Association of America. This specification (Diamond Dressing Tools, B67.1-1958, UDC No. 621.9.027) has received the approval of the American Standards Association. Copies are being distributed to standardization authorities in other countries.

SHARE OF PRODUCTION PLAN.—A booklet entitled " people, producuvity, progress," which has been issued by The F. R. Bentley Co., 128 Mount Street, Berkeley Square, London, W.1, gives an outline of a " share of production plan." This plan, it is claimed, results in increased productivity, wages, profits, reserves, and income tax payments. Briefly, under this plan, any increase in the production value achieved without added labour cost is divided between the company and labour in the same ratio that previously prevailed. Some typical case histories are given.

A LECTURE ENTITLED " CAN MANAGEMENT BE MADE A SCIENCE " will be held at The Polytechnic Hall, Calderwood Street, London, S.E.18, on November 18, at 7 p.m. Organized by the Woolwich Polytechnic, the lecture will be given by Mr. B. H. P. Rivett, head of the Operational Research Group of the National Coal Board, and will take the form of a critical examination of management at all levels, together with an appraisal of how the " scientific method " might be applied with advantage. Admission is free and applications for reserved seats should be sent to Mr. L. E. Glover, Woolwich Polytechnic, Thomas Street, Woolwich, London, S.E.18.

Somua Milling Machines—An Apology

Newman Industries, Ltd., Yate, Bristol, have asked us to publish a correction to an announcement made in MACHINERY, 93/1032—29/10/58, to the effect that they had been appointed sole selling agents in the United Kingdom for Somua milling machines. We are asked to state that this information was submitted to us in error and that Newman Industries, Ltd., apologise for the fact that it was published.

Dimensions for Worm Gear Units

A new British Standard (B.S. 3027: 1958—dimensions for worm gear units) gives the principal external and mounting dimensions for units of 4-in., 6-in. and 8-in. centre distances. The requirements are similar to those already observed by the gear manufacturing industry, and their incorporation in a national standard should promote interchangeability between the products of different makers. There are two appendices, the first of which lists preferred nominal gear ratios, and the second draws attention to the information which should be included in an order.

Copies of this publication may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1. [Price 3s.—postage extra to non-subscribers.]

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5/11/58

Coming Events

MANCHESTER ASSOCIATION OF ENGINEERS.—November 14, at 6.45 p.m., at the Engineers' Club, Albert Square, Manchester, 2; paper on "The Machining of Large Light Alloy Components by Computer Control," by J. Gregson and A. Flett.

INSTITUTION OF PRODUCTION ENGINEERS.—*Doncaster Section.* November 11, at 7 p.m., in the Technical College Hall, Doncaster; lecture on "Current Developments in the Field of Spark Machining," by J. E. Winford. *Leeds Section.* November 10, at 7 p.m., at the Hotel Metropole, Leeds; lecture on "Automation Tendencies in the U.S.A.," by Dr. D. B. Foster, Ph.D. *Ipswich and Colchester Section.* November 14, at 7.30 p.m., at the Golden Lion Hotel, Cornhill, Ipswich; lecture on "Joining Dissimilar Metals," by A. A. Smith, B.Sc., and J. G. Young, B.Sc. *Birmingham Graduate Section.* November 11, at 7 p.m., at the James Watt Memorial Institute, Great Charles Street, Birmingham; lecture on "The Engineering Applications of Nylon," by C. C. Morgan. *South Essex Section.* November 12, at 7.30 p.m., at the Ilford Club, 21a Balfour Road, Ilford; lecture on "The Application of Radio-active Isotopes in Industry," by J. L. Putman. *Edinburgh Section.* November 12, at 7.30 p.m., at the North British Hotel, Princes Street, Edinburgh; lecture on "Industrial Applications of Oil Hydraulic Equipment," by F. B. Levetus. An invitation is extended to anyone interested in the use of hydraulics in industry.

INCORPORATED PLANT ENGINEERS.—*Manchester Branch.* November 11, at 7.15 p.m., at the Engineers' Club, Albert Square, Manchester; paper on "Radio-isotopes in Industry," by W. G. Busbridge. *Western Branch.* November 12, at 7.15 p.m., at the Grand Hotel, Broad Street, Bristol; paper on "Education in Industry," by E. G. Sterland, M.A., B.Sc. (Eng.). *Birmingham Branch.* November 14, at 7.30 p.m., at the Hotel Leofric, Coventry; paper on "Maintenance of Automatic Plant," by J. Ward. *Halifax and Huddersfield Section.* November 17, at 7.30 p.m., at Whiteley's Cafe, Westgate, Huddersfield; lecture on "Use of Radio Isotopes in Industry," by D. B. Smith. *Newcastle-upon-Tyne Section.* November 17, at 7 p.m., in No. 1 Chemistry Lecture Theatre, Kings College, Newcastle-upon-Tyne; lecture on "The Bases of Measurement," by Dr. H. Barrell, D.Sc.

New EDA Films

Two new films illustrating the advantages of electric power have recently been added to the library of the British Electrical Development Association, 2 Savoy Hill, London, W.C.2.

One of these films, entitled "The Future is Electric," is in colour and is concerned with the reduction of atmospheric pollution which can be achieved by making greater use of electrical energy and by burning less coal. The other film—"Time for Lunch"—shows scenes in a works canteen where some 400 people are quickly served each day with lunch cooked in electric ovens.

The films may be obtained from the Association, on loan, in both 16- and 35-mm. sizes.

Machine Tool Exports and Imports

EXPORTS OF MACHINE TOOLS

Type of Machine	Month ended July 31, 1958	Seven months ended July 31	
		1957	1958
	Value £	Value £	Value £
New, complete—			
Boring machines:			
Vertical	45,655	239,438	341,023
Other	85,447	553,534	494,639
Drilling machines	158,956	1,288,236	1,136,313
Grinding (excluding thread grinding), lapping and honing machines	220,339	1,662,278	1,311,629
Lathes:			
Automatic	82,971	1,149,525	784,988
Capstan	158,495	1,625,197	1,248,322
Other	255,585	2,023,698	1,671,146
Screwing machines	49,353	138,938	167,215
Threading machines	25,387	376,149	209,275
Milling machines (excluding thread milling) and gear cutting machines	273,557	1,439,817	1,446,496
Planing, shaping and slotting machines	59,812	474,836	532,463
Presses:			
Hydraulic	71,497	827,052	346,083
Other	87,951	572,746	795,440
Punching and shearing machines	32,696	300,226	264,728
Other plate and sheet metal working machines including straightening rolls	66,066	221,844	467,134
All other machines	338,293	1,816,922	1,705,992
Used machines, complete	84,446	497,888	466,572
Parts	180,205	1,402,931	1,323,475
Total	2,276,711	16,611,255	14,712,933
Destination			
Union of South Africa	184,622	955 610	1 059,081
India	349,925	2,167,550	2,445,529
Australia	389,358	2,514,942	2,157,957
New Zealand	39,766	242,036	235,350
Canada	140,177	1,273,093	991,424
Other Commonwealth countries	197,947	933,847	1,079,117
Soviet Union	8,280	699,228	72,878
Sweden	86,719	481,431	357,480
Western Germany	41,101	293,357	320,014
Netherlands	61,850	518,352	339,485
France	241,135	1,344,413	1,187,625
Spain	66,807	906,951	933,746
Italy	37,864	505,992	509,013
U.S. America	69,002	1,649,341	762,453
Other foreign countries	362,158	2,125,112	2,261,781

IMPORTS OF MACHINE TOOLS

New, complete—			
Boring machines	175,637	1,570,848	699,179
Drilling machines	13,781	270,629	118,438
Gear-cutting machines	59,548	669,190	402,150
Grinding, lapping and honing machines	342,052	1,366,490	1,534,913
Lathes:			
Automatic	159,017	1,287,610	1,423,672
Other	19,791	148,973	148,131
Milling machines	126,748	1,528,268	1,136,304
Planing, shaping and slotting machines	17,186	197,606	158,921
Presses	125,668	559,150	541,276
All other machines	441,749	3,024,152	2,626,150
Used machines, complete	21,190	215,674	295,406
Parts	381,768	2,524,635	2,028,225
Total	1,884,135	13,363,225	11,112,765
Country of Origin			
Western Germany	703,345	5,203,779	3,926,272
Switzerland	286,243	1,585,301	1,690,496
U.S. America	656,273	4,539,004	3,440,446
Other foreign countries	238,274	2,035,141	2,055,551

Personal

MR. PHILIP DE HAVILLAND informs us that he has resigned from Philip de Havilland Machine Co., Ltd., Portsmouth.

MR. B. D. BOWMAN, B.Sc.(Eng.), A.M.I.Mech.E., has been appointed technical sales manager to Metaducts, Ltd., Catherine Wheel Road, Brentford, Middlesex.

MR. R. F. WEBB, B.Sc., Ph.D., has joined the staff of CIBA (A.R.L.), Ltd., Duxford, where he will be responsible for directing a number of specialist groups engaged in research into new plastics materials.

MR. R. J. GRESLEY, A.M.I.E.E., has been appointed chief engineer of the Power and Distribution Transformer Division of the Gresham Transformer Group, Twickenham Road, Hanworth, Middlesex.

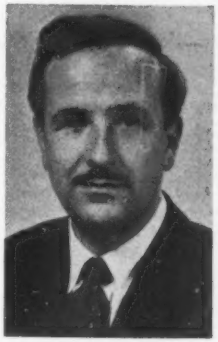
MR. H. C. PITCH has joined the staff of Sidney G. Jones, Ltd., 8 Balham Hill, London, S.W.12, as sales engineer for East Anglia, Hertfordshire, Bedfordshire, Essex, Middlesex and North and East London.

MR. P. D. OSBORN, B.Sc. (Eng.), A.M.I.E.E., will assume complete responsibility for the sale of motors produced at the Guiseley factory of Crompton Parkinson Ltd., Crompton House, Aldwych, London, W.C.2. He will continue to represent the company in trade association matters. MR. C. J. TEASDEL has been appointed product sales manager, Chelmsford machines, which include large motors, D.C. marine motors, generators and alternators.

MR. JOHN G. FRASER, chairman of Douglas Fraser & Sons, Ltd., Arbroath, Scotland, has relinquished his duties as sales director, and has been succeeded in this capacity by MR. JOHN MACGREGOR. To ensure a progressive design and development policy in connection with the machine tool activities, MR. NORMAN FRASER has been appointed machine tool design director. Textile machinery development will remain under the direction of MR. HUGH FRASER, who will also undertake more general duties associated with the establishment of additional products. MR. WILLIAM SOMERVILLE has been elected to the board, and succeeds Mr. Norman Fraser as works director. Mr. DAVID H. WALLACE, who recently retired from the position of works manager of the Engineering Division, will remain a director and has accepted the post of works engineer.

Mr. J. Macgregor

Mr. W. Somerville



Mr. F. Dodgson

MR. FRANK DODGSON, A.M.I.Mech.E., A.M.I.Prod.E., chief engineer, of Churchill-Redman, Ltd., West End Works, Parkinson Lane, Halifax, has recently been appointed a director of the company. He began his apprenticeship with the company in 1935, and after three years' workshop training, entered the drawing office. In 1948 he was appointed chief draughtsman, and in 1955 became chief engineer. Mr. Dodgson has travelled extensively on business in the U.S.A., Canada, and Europe. He was responsible for the design and development of the first hydraulically-operated production profile-turning lathe to be built in England, and is the author of papers on this subject.

MR. D. R. WESTERN, 115 Overcliff Drive, Southbourne, Bournemouth, has recently been appointed technical representative for Londex, Ltd., Anerley Works, 207 Anerley Road, London, S.E.20, for the Dorset, Hampshire, and West Sussex area.

MR. C. E. HUCKER has been appointed manager of the Plant Division of the Cardiff branch of Crompton Parkinson, Ltd., Crompton House, Aldwych, London, W.C.2. He joined the company in 1948, and was formerly a sales engineer in the Bristol area.

Mr. H. E. COOPER has been appointed managing director of G. A. Harvey & Co. (London), Ltd., Greenwich Metal Works, London, S.E.7. He first became a member of the Board in 1946, and has acted as deputy managing director since May of this year. MR. I. A. MARRIOTT succeeds Mr. P. T. Bliss as sales director. Mr. Bliss, who has been with the company for 50 years, will retire on December 31.

VICE-ADMIRAL SIR FRANK MASON, K.C.B., M.I.Mech.E., M.I.Mar.E., has been appointed by The Lord President of the Council to be a member of the Council for Scientific and Industrial Research. A director of Metal Industries Ltd., and H. W. Kearns & Co., Ltd., and consultant to Metropolitan-Vickers Electrical Co., Ltd., Sir Frank was appointed chairman of the Mechanical Engineering Research Board last June. Before his retirement from the Royal Navy in 1957 he was Engineer-in-Chief of the Fleet.

Variomatic Machines

An article published in MACHINERY, 93/815—8/10/58, described the production of electrical components on Variomatic machines. The selling agents for these machines in this country, who are Sidney G. Jones, Ltd., 8 Balham Hill, London, S.W.12, have asked us to point out that Variomatic machines are built by Hahn & Kolb, Stuttgart, Western Germany.

Trade Publications

BROOKES (OLDBURY), LTD., Oldbury, Birmingham. Two leaflets describing the range of hydraulic guillotine shears, and the latest additions to the range of tube cutting-off machines. The new 5-in. tube cutting machine is similar in principle to the previously made 2-in. and 4½-in. types, and in its standard form can be operated on semi- or fully-automatic cycles, the change-over being effected by a single lever movement. Guillotine shears are available in capacities ranging from 6 ft. by ¼ in. up to 12 ft. by 1 in.

E. P. BARRUS, LTD., 12/16 Brunel Road, Acton, London, W.3. Catalogue No. IP2 covers the entire range of Blackhawk hydraulic Porto-Power equipment, and gives full details and comprehensive specifications of the new push-pull Holl-O-Ram hydraulic units.

BRITISH INSULATED CALLENDER'S CABLES, LTD., 21 Bloomsbury Street, London, W.C.1. Publication No. 287B is concerned with the company's new claw-type cable cleating system. This system has been developed to meet the need for a universal assembly which can be built up, modified, or adapted, on site, to suit any particular arrangement of cables.

Machine Tool Share Market

After displaying some irregularity, stock markets developed a steady to firm tone in the principal sections, and the period under review closed on a good note.

The gilt-edged section suffered some slight setbacks at the outset, but gradually rallied to finish with improvements in prices among British Funds and similar fixed interest stocks.

Early dullness and uncertainty in commercial and industrial share markets gave place to generally bright conditions, with the trend upwards under the influence of a number of favourable factors, and a few features devoleped in response to satisfactory dividend announcements.

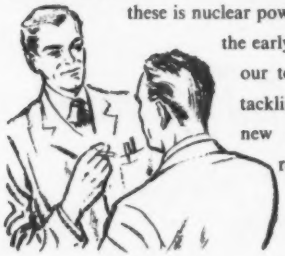
Among machine tool issues Edgar Allen advanced 6d. to 36s. 6d.; Asquith Machine Tool, 1s. 1½d. to 23s. 1½d.; Birmingham Small Arms, 2s. 6d. to 35s.; Chas. Churchill, 7½d. to 6s. 1½d.; Churchill Machine Tool, 1½d. to 18s. 3d.; John Harper, 1½d. to 16s.; John Shaw & Sons (Wolverhampton), 1½d. to 14s. 3d.; Craven Bros. (Manchester), 6d. to 8s. 6d.; and W. E. Sykes "B" ordinary, 6d. to 22s. 6d. On the other hand, British Oxygen lost 1s. at 43s. 6d.; Broom & Wade, 1s. at 12s. 6d.; Geo. Cohen, 3d. at 10s. 9d.; and Kitchen & Wade, 3d. at 8s.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrongs, Stevens & Son, Ltd.	Ord.	5/-	8/3
Allen (Edgar) & Co., Ltd.	Ord.	£1	36/6
" "	5% Prf.	£1	15/3*
Arnott & Harrison, Ltd.	Ord.	4/-	15/6
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	23/1½
" " "	6% Cum. Prf.	£1	18/6
Birmingham Small Arms Co., Ltd.	Ord.	£1	35/-
" " "	5% Cum. "A" Prf.	£1	15/6
" " "	6% Cum. "B" Prf.	£1	18/-
" " "	4% 1st Mort. Deb.	Stk.	88½
British Oxygen Co., Ltd.	Ord.	£1	43/6
" " "	6½% Cum. Prf.	£1	22/-
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	3/10½
Broom & Wade, Ltd.	Ord.	5/-	12/6
" "	6% Cum. Prf.	£1	17/9
Brown (David) Corporation Ltd.	5½% Cum. Prf.	£1	15/6
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/9
Butler Machine Tools Co., Ltd.	Ord.	5/-	8/-
" " "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	11/3
Churchill (Charles) & Co., Ltd.	Ord	2/-	6/1½
" " "	6% Cum. Prf.	£1	26/4½
Churchill Machine Tool Co., Ltd.	Ord.	5/-	18/3
" " "	6% Cum. Prf.	£1	18/3
Clarkson (Engrs.), Ltd.	Ord.	5/-	15/-
Cohen (George), Son & Co., Ltd.	Ord.	5/-	10/9
" " "	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	17/-
" " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	8/6
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/6
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/-
" "	4½% Red. Cum. Prf.	£1	13/9
Expert Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/6
Greenwood & Batley, Ltd.	Ord.	£1	52/6
Harper (John) & Co., Ltd.	Ord.	5/-	16/-
" "	4½% Red. Cum. Prf.	£1	12/10½
Herbert (Alfred), Ltd.	Ord.	£1	36/3
Holroyd (John) & Co. Ltd.	"A" Ord.	5/-	12/6
" " "	"B" Ord.	5/-	12/3
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	22/-
" " "	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	46/6
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/-
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/3
Kitchen & Wade, Ltd.	Ord.	4/-	8/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	1/6xd
Massey, B. & S., Ltd.	Ord.	5/-	9/-
Modern Engineering Machine Tools Ltd.	Ord.	5/-	10/7½
Newall Engineering Co., Ltd.	Ord.	2/-	4/9
Newman Industries, Ltd.	Ord.	2/-	2/9
" "	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	3/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	21/-
" " "	5½% Cum. Prf.	£1	26/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	22/6
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/6
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	43/6
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	14/3
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	13/6
" " " "	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	7/6
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	22/6
Tap & Die Corporation, Ltd.	Ord.	5/-	8/-
" " "	4½% Deb. 1961-1977	Stk.	82/-
Wadkin, Ltd.	Ord.	10/-	18/9xd
Ward (Thos. W.), Ltd.	Ord.	£1	87/-
" "	5% Cum. 1st Prf.	£1	16/-
" "	5% Cum. 2nd Prf.	£1	24/-
Willson Lathes, Ltd.	Ord.	1/-	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.

Have Ransome and Marles been associated with any of the big developments in British industry?

We don't hit the headlines — but we often help to make headline news possible. Since the war we have carried out research into design, materials, lubrication and production for a number of important projects. One of these is nuclear power generation. From the early days of Calder Hall our technicians have been tackling fresh problems as new and more powerful reactors are designed.



Are there any other interesting projects?

Yes, several. Britain has been achieving a world-wide success with her aircraft engines. Two notable users of R&M Bearings are Armstrong-Siddeley Motors and Bristol Aero Engines. The Proteus engines of the latest Bristol Britannia are of course fitted with R&M Bearings.

Then again "automation" is a popular word these days. We at R&M are becoming increasingly "automatic" in many of our processes in shops and offices. We also supply the bearings for the latest electronic machines. Our customers include Powers Samas, Elliott Brothers, IBM and British Tabulating Machines — just another example of the role played by R&M in all fields of industrial development.

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Ask for publication SP. 178

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Machine shop maintenance is always complicated but the task can be simplified by a FLETCHER MILLER Lubrication Survey — Your maintenance requirements are expertly analysed and grouped — with all data clearly set out in a permanent record. May we help you in this way?

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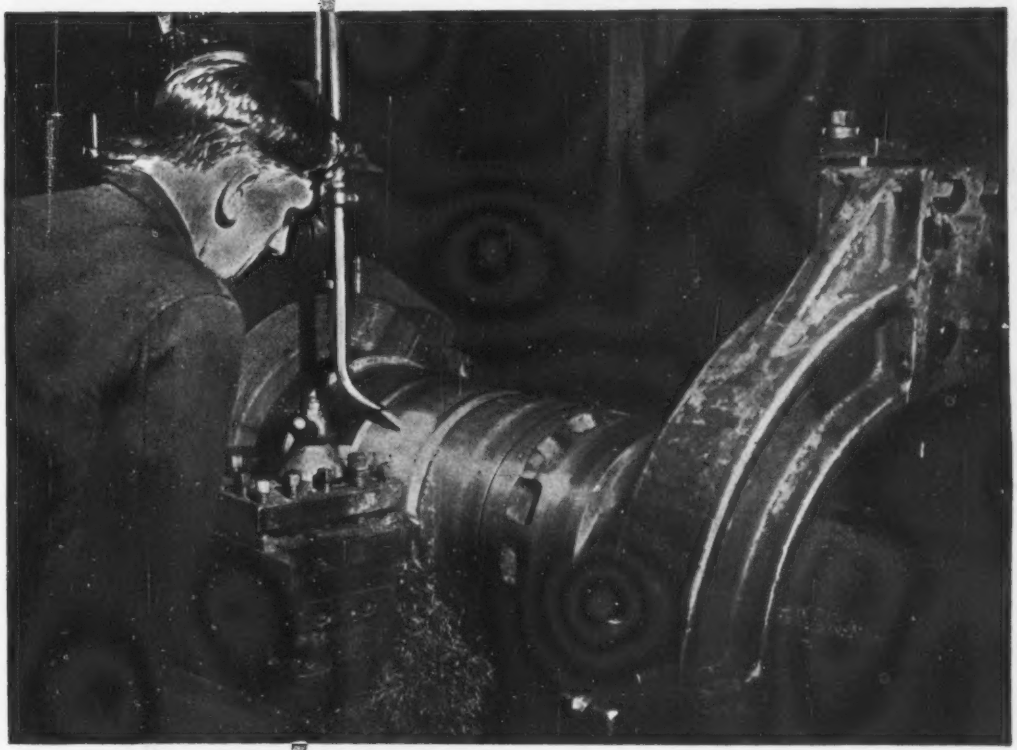
SOLUBLE CUTTING OILS

chosen by CROSSLEY BROTHERS LTD



Dixol is used on this intermediate machining operation on a cylinder liner for a Crossley diesel.

Crossley Brothers have been engineering specialists for as long as 91 years, and the soluble cutting oils they use to aid them manufacture their diesel engines are "Dixol" grades, production oils of proven quality and performance—backed by 104 years of specialised experience in lubrication!

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INDUSTRIAL WAKEFIELD-DICK LUBRICANTS

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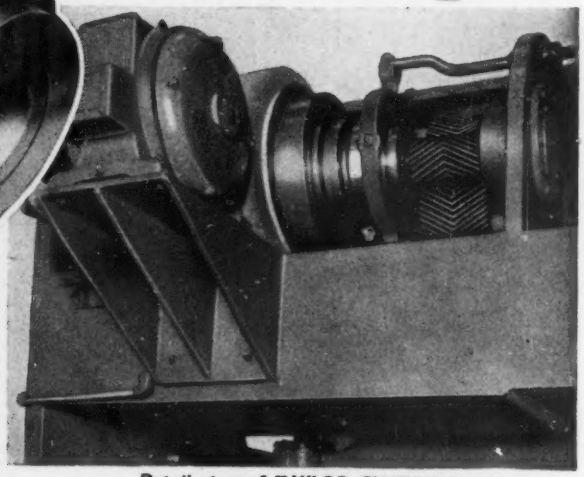

Detail view of TAYLOR CLUTCH fitted to fly wheel on Press Brake.

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CLUTCHES

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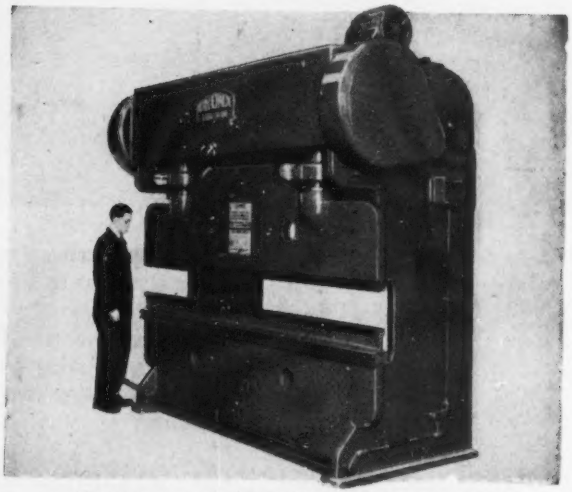
The TAYLOR MULTIPLE DISC CLUTCHES are standardised on the BRONX PRESS BRAKES, which are capable of high speed production. Smooth, easy engagement and quick, positive release are prime essentials on this class of machine, and the TAYLOR CLUTCHES are designed, built and applied to ensure these necessary features. Suitable for all classes of industrial machinery.

Details gladly sent on request. Please write us.



General view of above, 150 ton by 12 ft. PRESS BRAKE.

Photograph by courtesy of The Bronx Engineering Co. Ltd., Lye, Nr. Stourbridge, Worcs.

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Renold Chain Drives can contribute in a big way to efficient space usage

Consider these facts :-

- Owing to its extreme strength in relation to its cross-sectional area, a narrow width of all-steel roller chain is able to transmit considerable power. In addition, as the contact between chain and wheels constitutes a gearing action, the ability to transfer power does not depend on frictional contact, i.e. on large wheel diameters.
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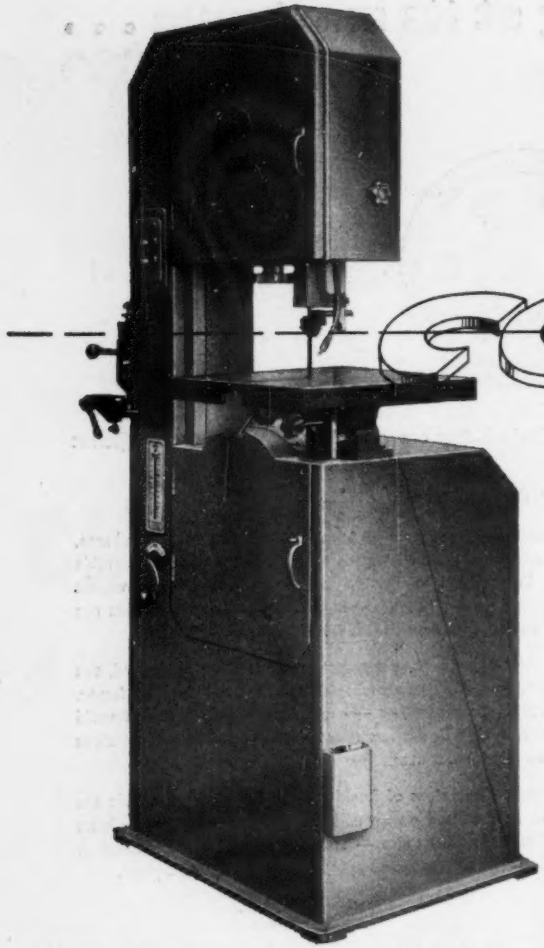

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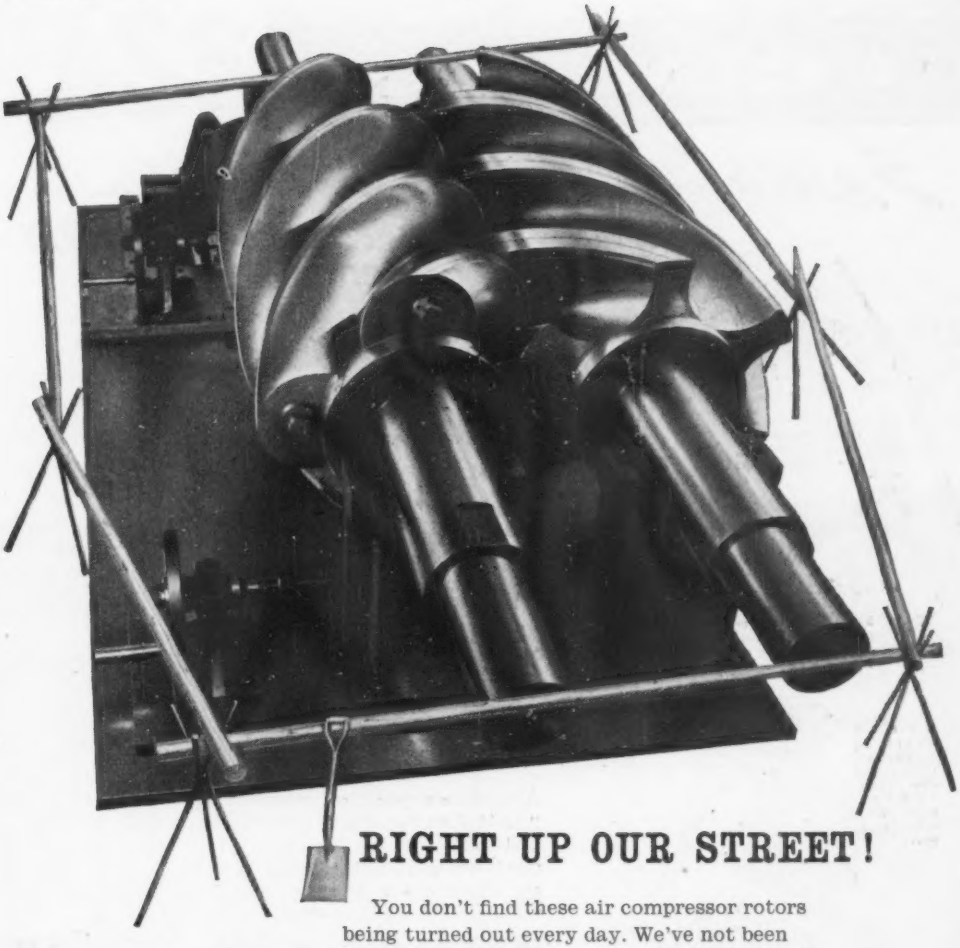
And at Glasgow, Banbury, Belfast



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You don't find these air compressor rotors being turned out every day. We've not been making them long ourselves. But we've been thinking about them for ages. In working out a manufacturing technique, our long experience in the production of accurate worm gears was an invaluable asset. We have now developed an entirely new machine for the exclusive production of rotors and high lead angle pump screws. If you've got a job of this sort . . . you're right up our street!

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With acknowledgement to James Howden & Co. Ltd., for whom we made the above rotors.

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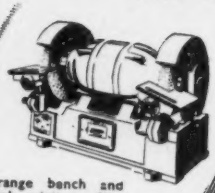
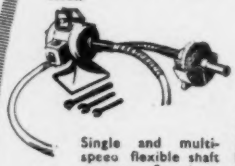
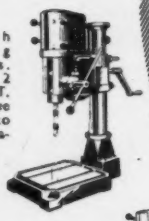
Specialists in machines for
INCREASED PRODUCTION



Full range bench and pedestal grinders—6in., 8in., and 12in. wheel sizes.

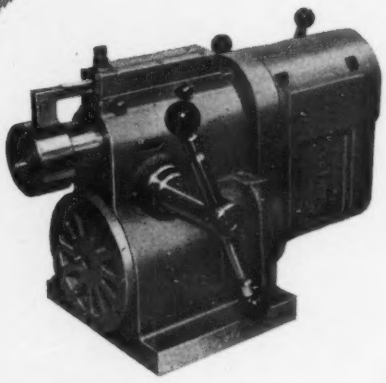


Single and multi-speed flexible shaft grinders. Speeds up to 41,000 r.p.m.



Bench drilling machines. M.T. No. 2 and M.T. No. 3. Three sizes up to 1¼in. capacity.

Column drilling machines, with or without power feeds. Capacities up to 1¼in.



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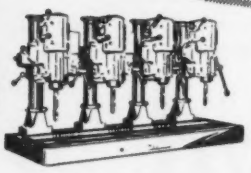
A logical development of the famous range of "GRIMSTON Electriska" Drilling Machines, these UNIT HEADS are available with 4, 8, 12 or 16 spindle speeds arranged with hand feed or hand feed and one or more geared power feeds. Other arrangements with hydraulic-pneumatic controls can also be offered.

Ask for further details quoting Ref. M8.



Production drilling machines with up to four heads, 4, 8, 12 or 16 speeds, with or without power feeds.

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In addition to the range of standard machine tools, as shown, we also offer full facilities for the design, development and manufacture of special purpose machines, employing mechanical-hydraulic-pneumatic-feeds as suitable for operations on the component.

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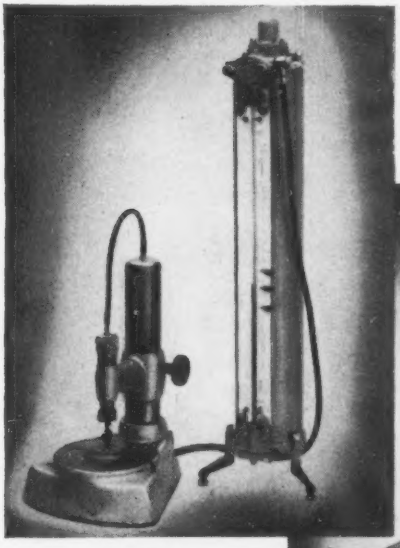
Solex Comparators mean fast, dependable gauging of components

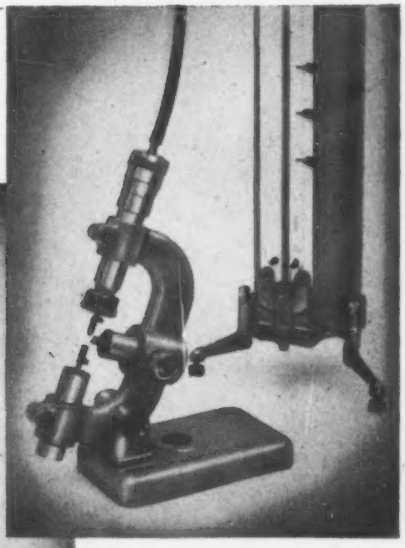
MAGNIFICATION: 4000/1, 12000/1, 23000/1

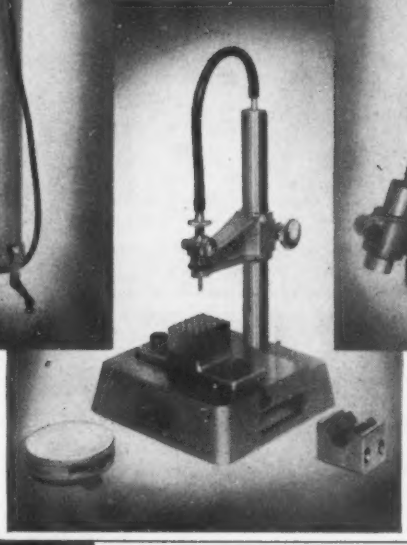
There is a SOLEX air-operated comparator for every purpose, in tool room, standards room or production line. Like all Solex Gauges, these comparators are designed to ensure precision and accurate magnification at the fastest possible rate so that speed and high quality of production are sustained.

SOLEX air operated comparators are easy to operate and require little maintenance or operator skill.



The 10M Vertical Comparator is designed for external measurements of small and medium sized workpieces.





The 28C is a versatile, extremely accurate instrument designed for standards room use but sturdy enough for the workbench also.

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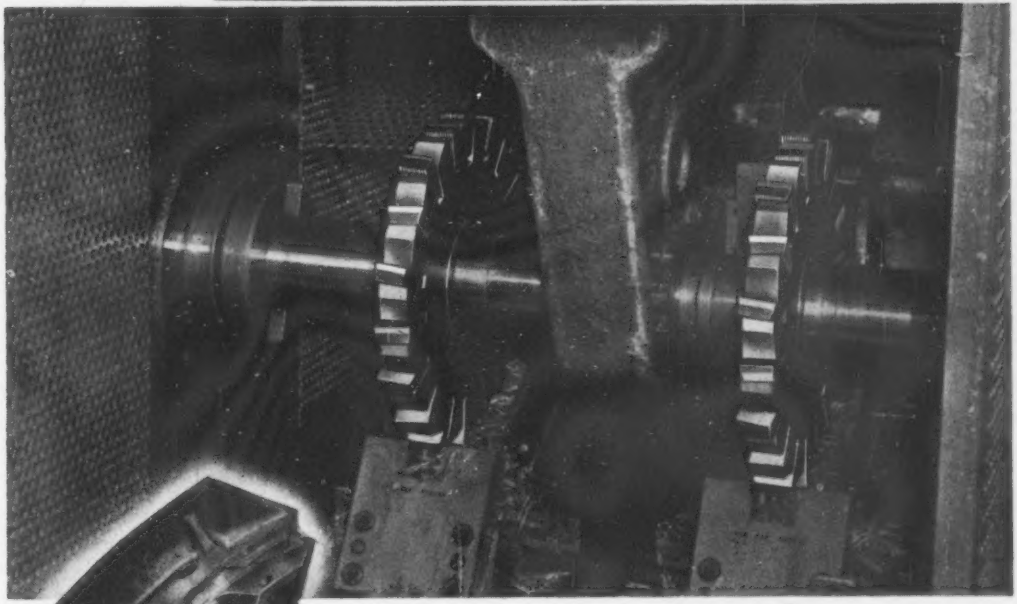

with... Galtona O-K

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To maintain rigid production schedules on the large scale production of brake shoes, Girling Ltd., make extensive use of "GALTONA-O.K." serrated blade cutters.
For machining the lever groove in twin-web malleable iron shoes illustrated, two Stellite tipped Alternate Angle Cutters, 10in. diameter, 1¼in. wide, are used. Each Cutter has 24 blades, 12 each right and left hand.
There are "GALTONA-O.K." serrated blade cutters available for all types of milling operations. Write for details.

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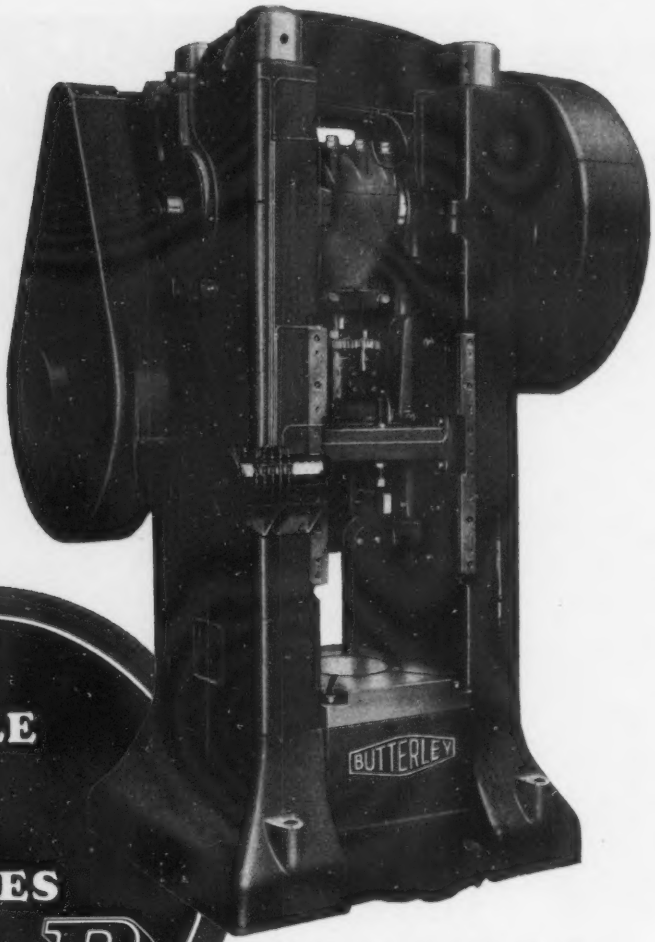

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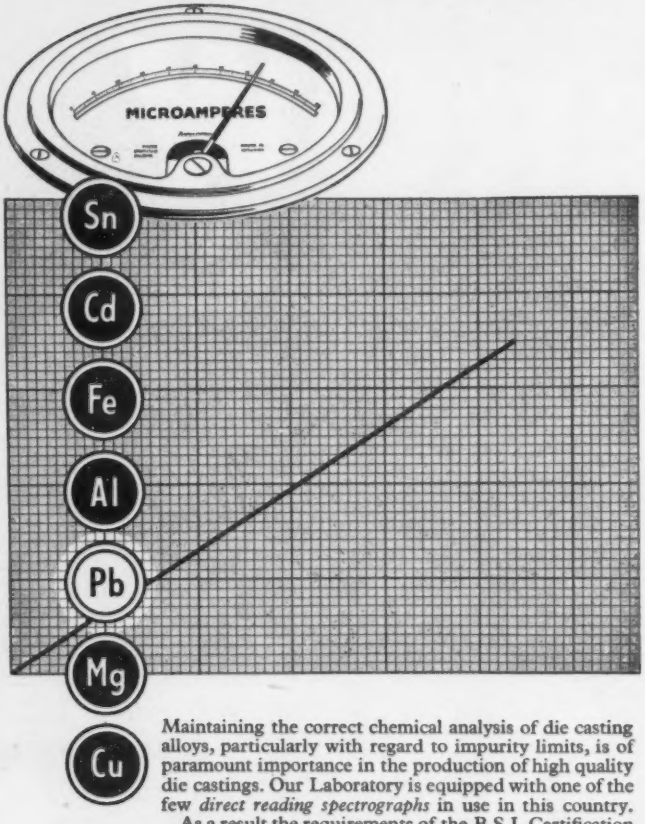
of pressure die castings



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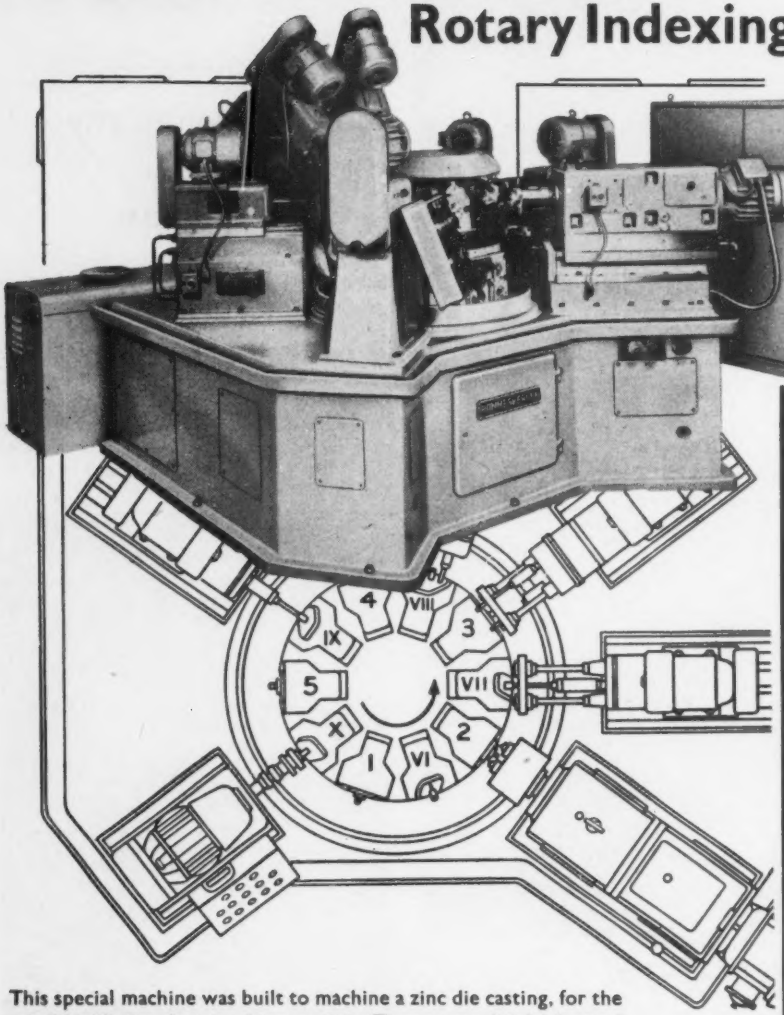
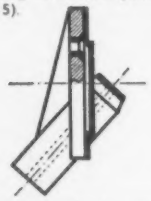
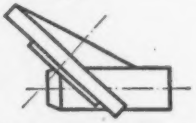


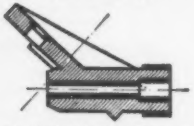
Casting loaded for machining during 1st rotation (stations 1 - 5).



Parts shown after 1st rotation (faced, drilled and spotfaced end milled).



Part premachined at stations 1 - 5 loaded for stations VI - X (2nd rotation).



Finished part after 2nd rotation (step drilled, deburred, reamed, tapped).

Output: approx. 220 pieces per hr. at 85% efficiency.

This special machine was built to machine a zinc die casting, for the windshield wiper bearing shown at right. The operator's job is limited to loading, reclamping and unloading of these parts. The machine is built up of three single-spindle drilling units, two slide units with built-on 2-spindle drilling heads, one facing unit with hydraulic shuttle table, one tapping unit and one hydraulic rotary indexing table.

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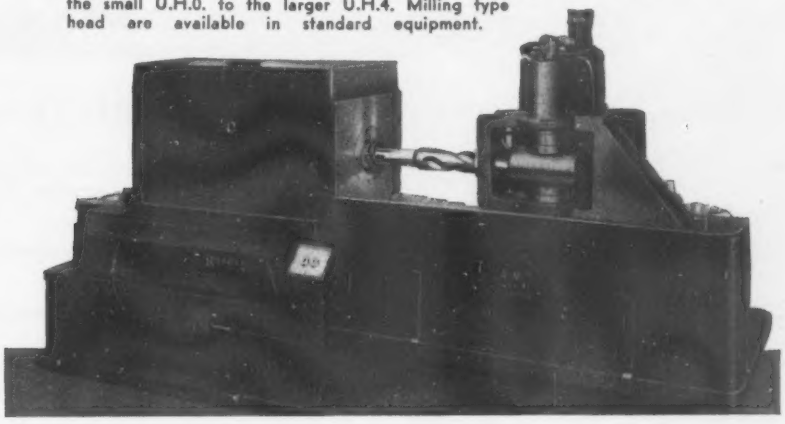

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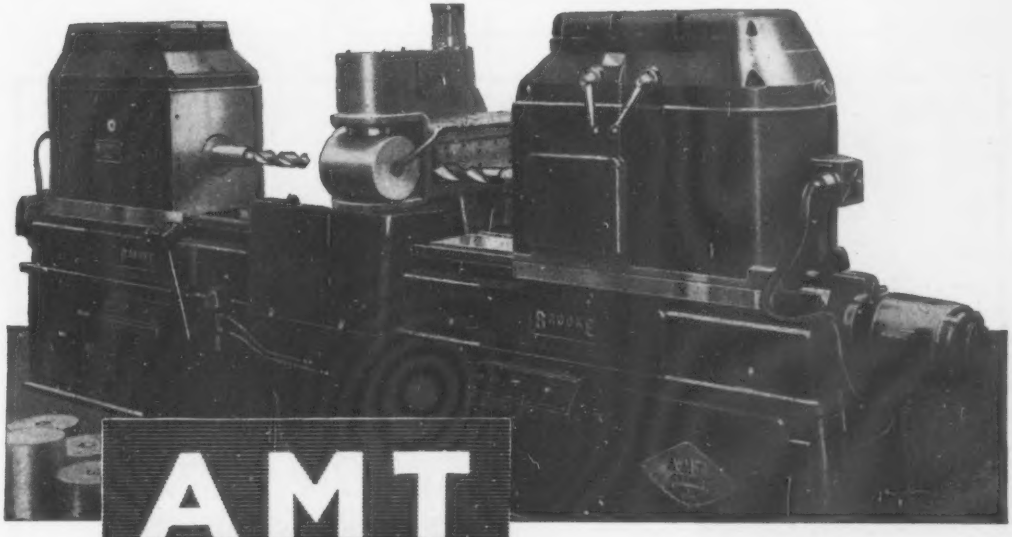

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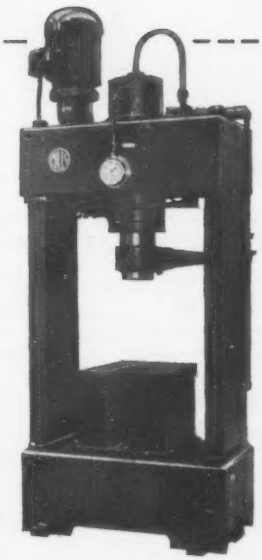

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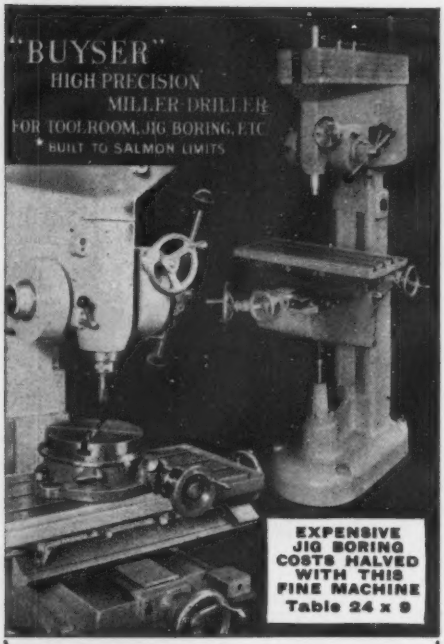

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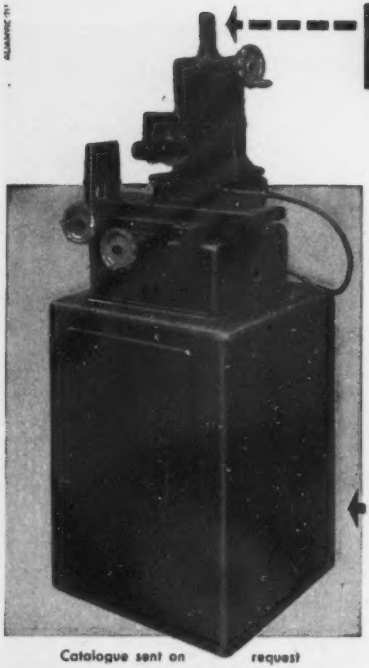

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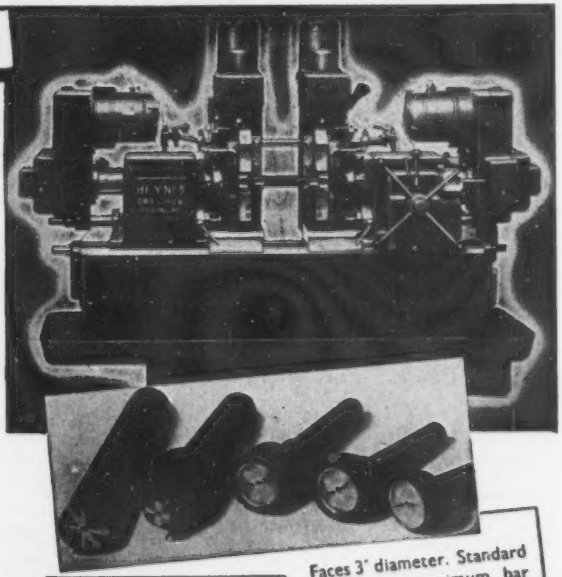

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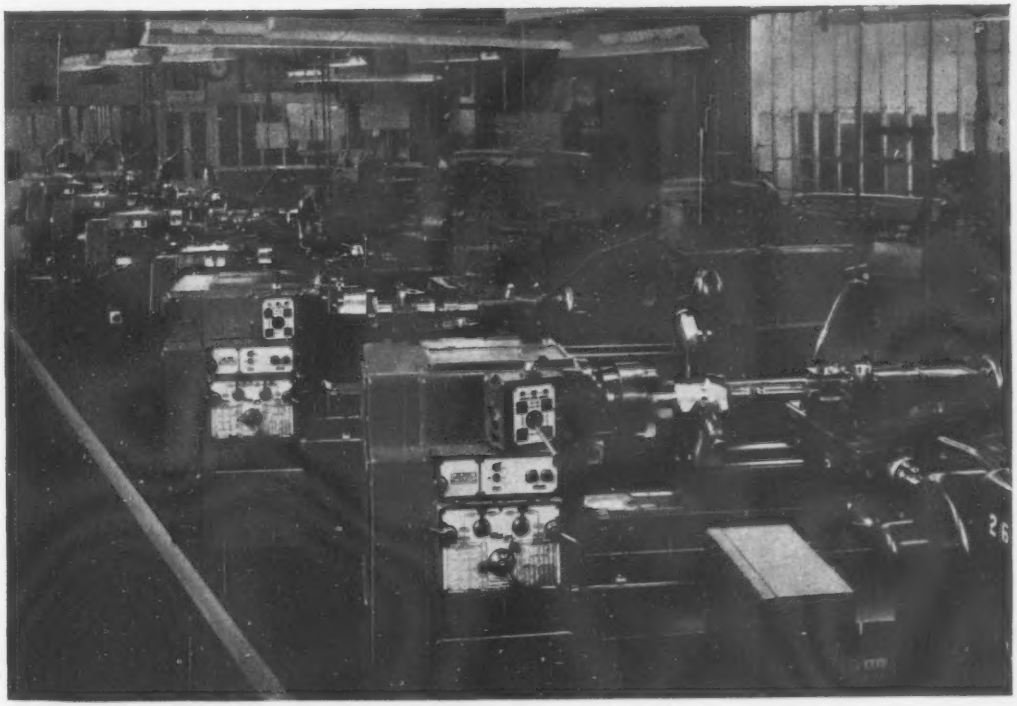

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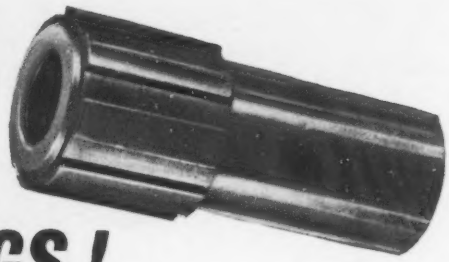

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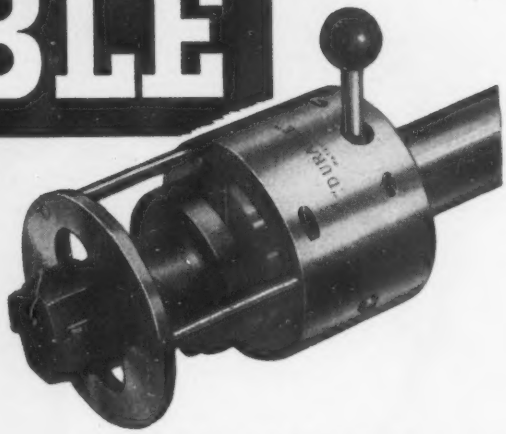

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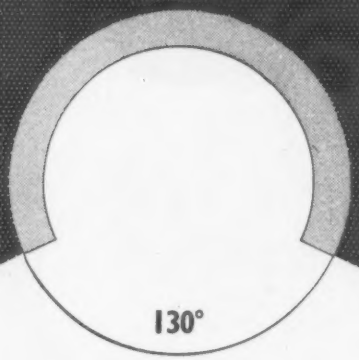

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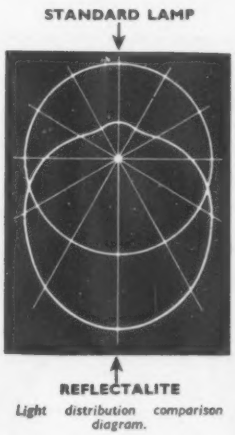

Light distribution comparison diagram.

Philips "Reflectalite" is the fluorescent tube that defeats light wastage caused by dust accumulation. And today it's a better buy than ever. For, in addition to its basic increase in lighting efficiency, the light output of "Reflectalite" tubes has now been further increased to give you *even more light* in the useful direction. For instance, the 40W Cool White tube now has 10% greater efficiency.

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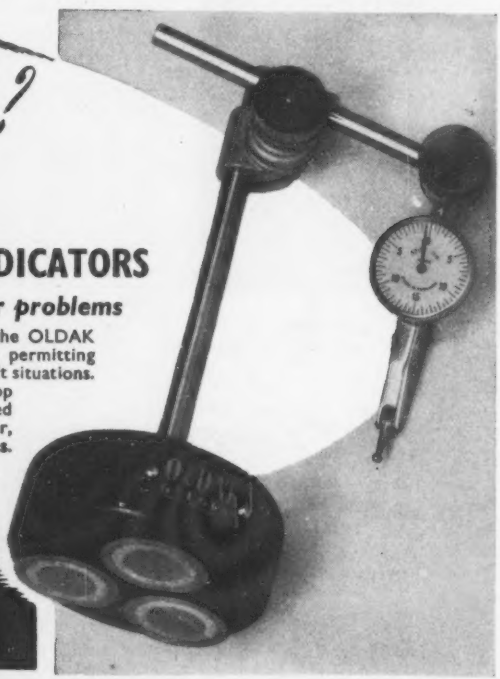

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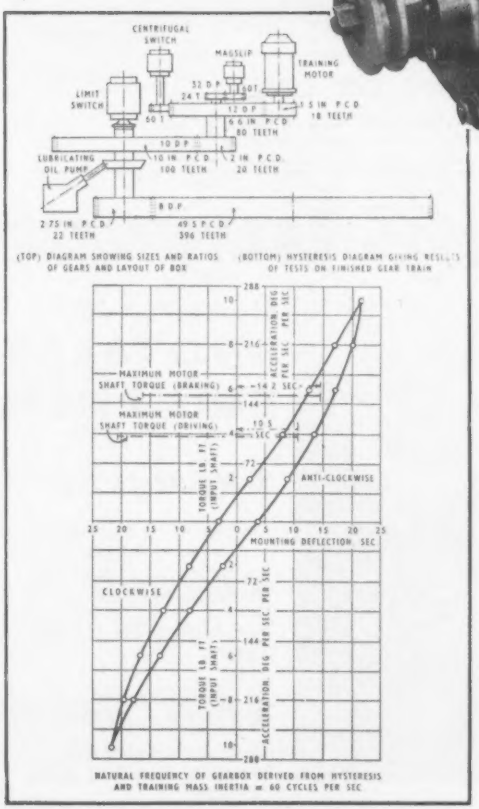

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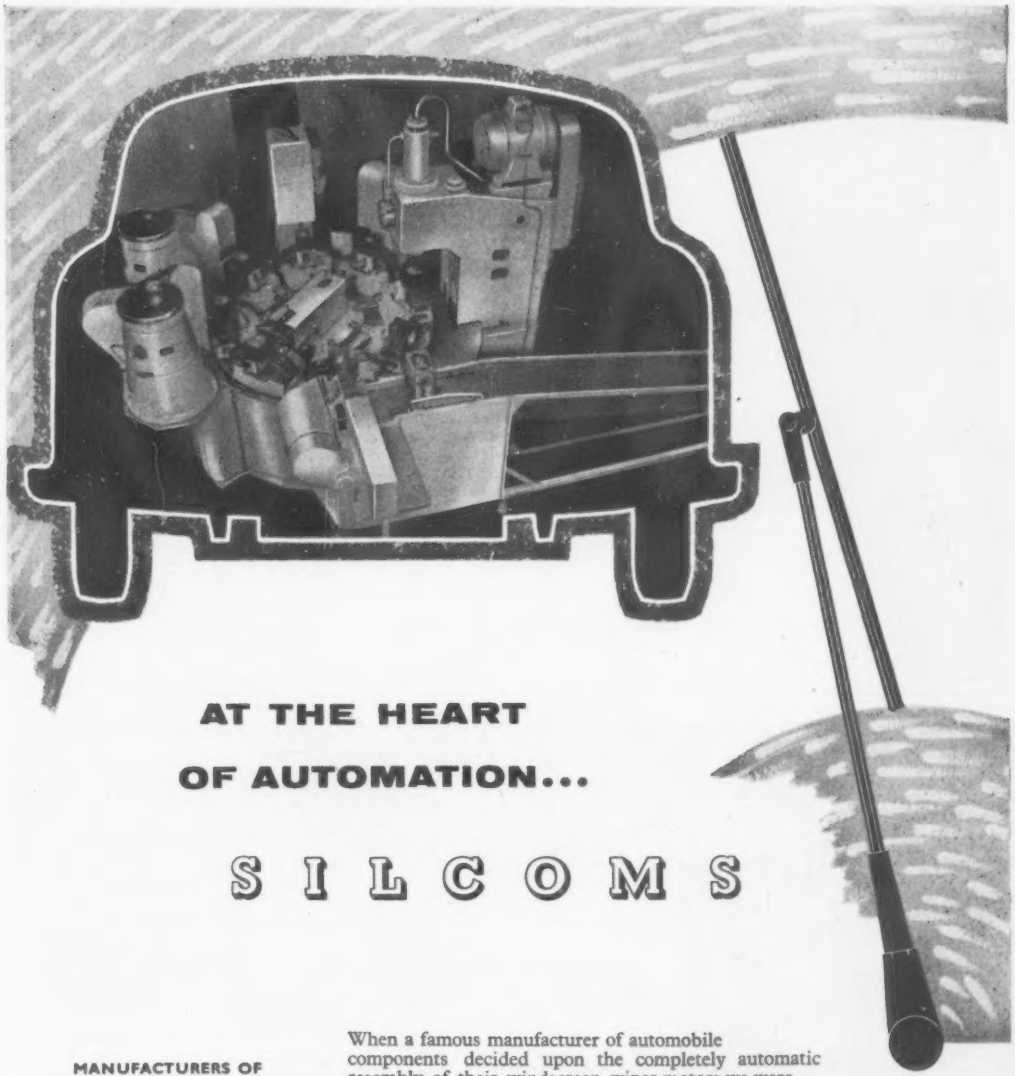

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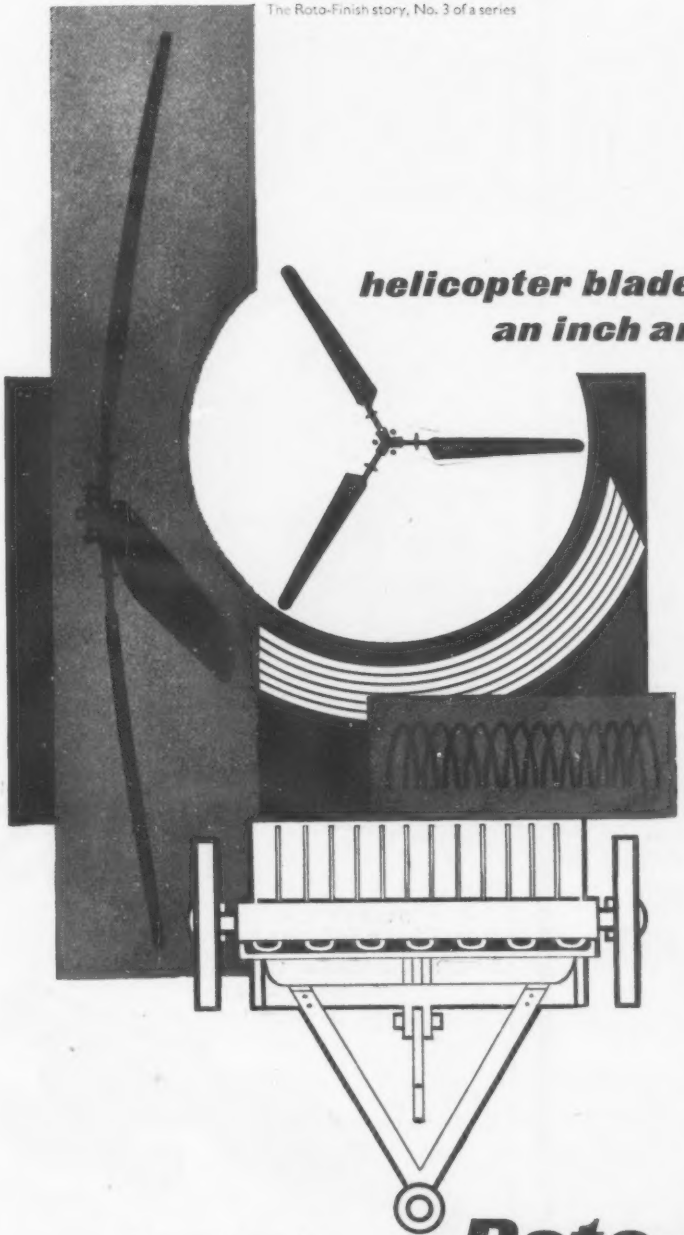

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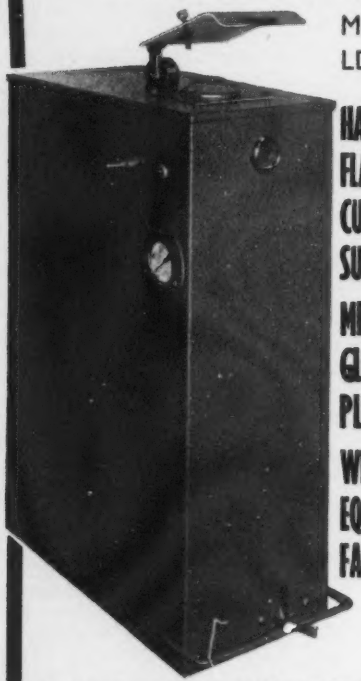

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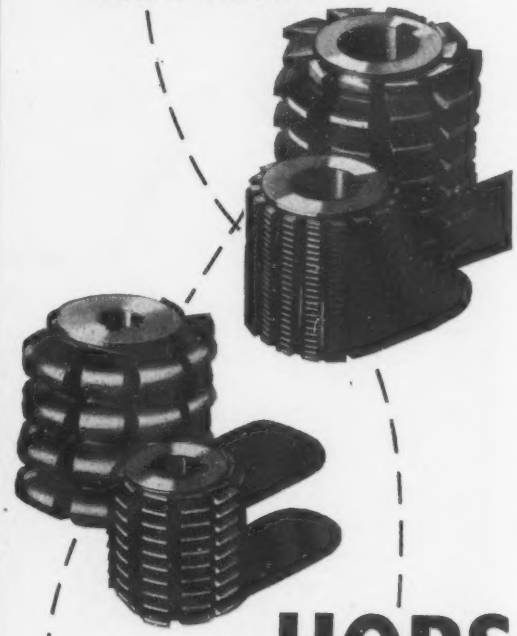

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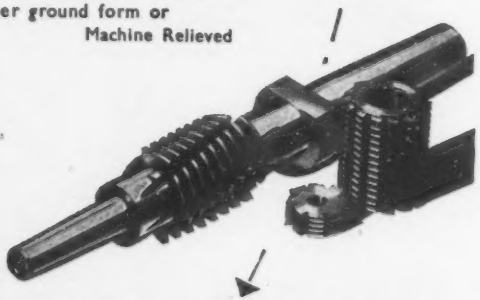

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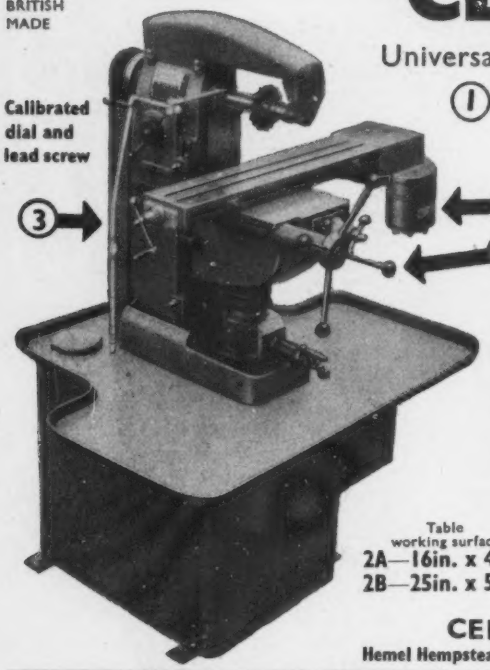

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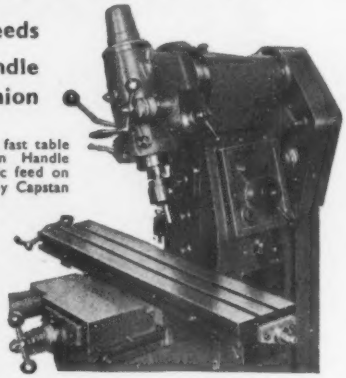

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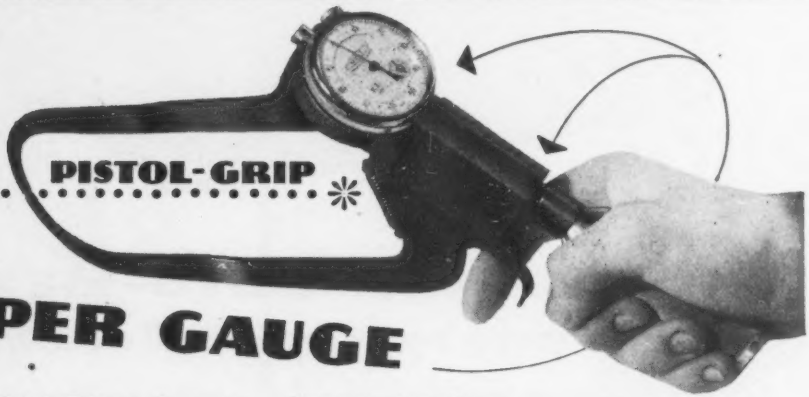

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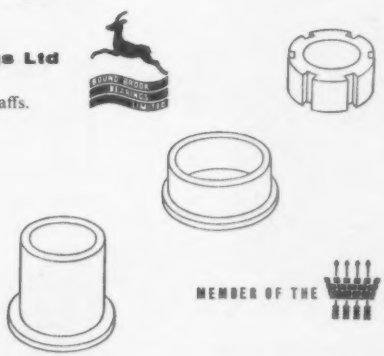

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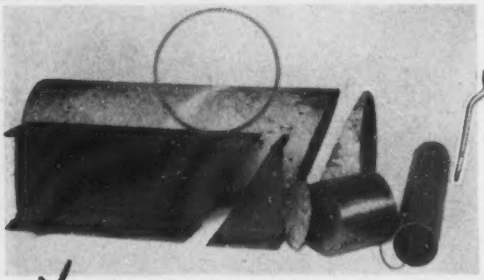

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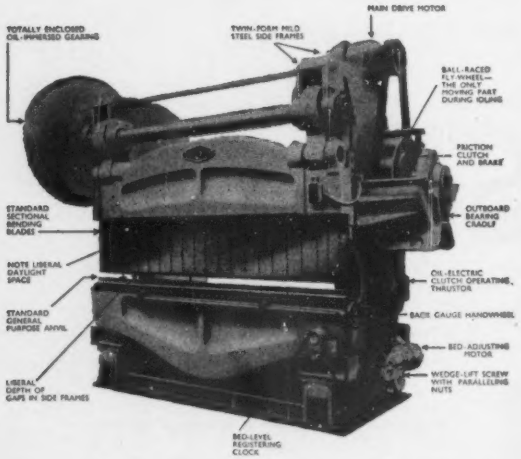
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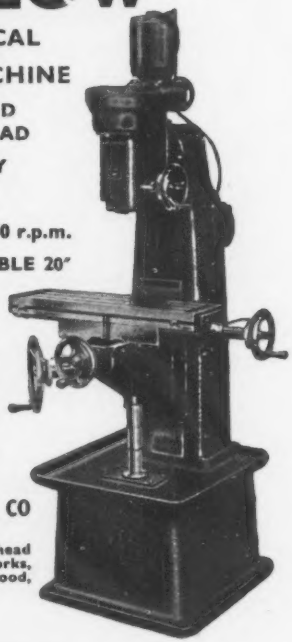

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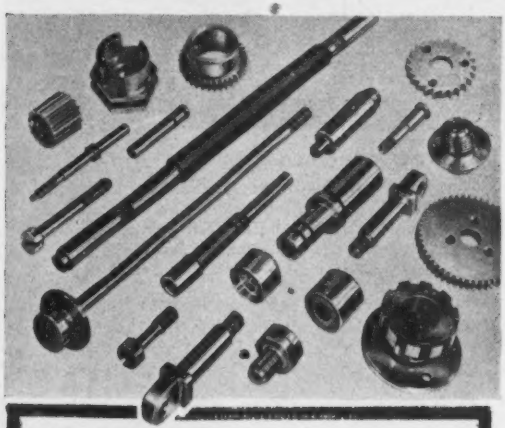

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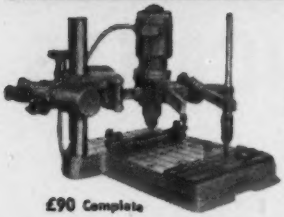

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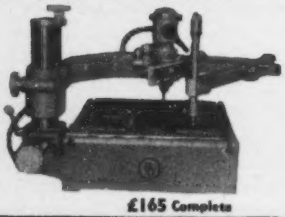

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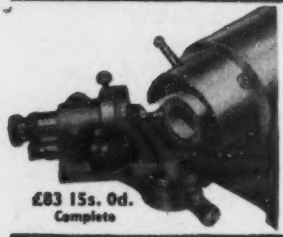

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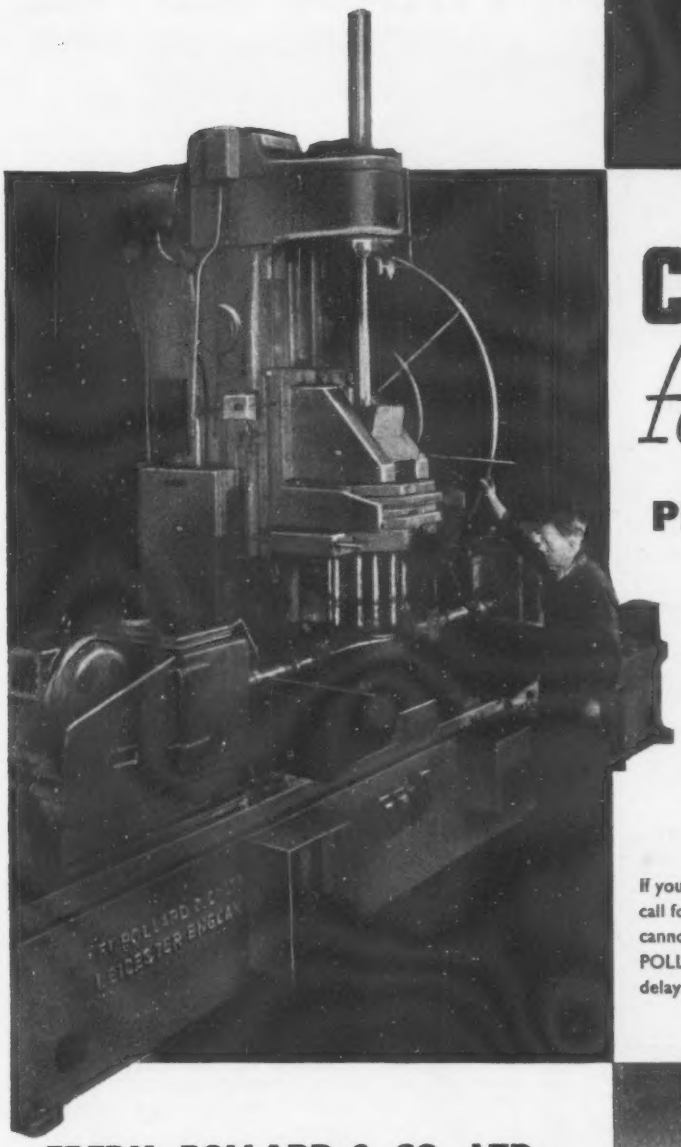

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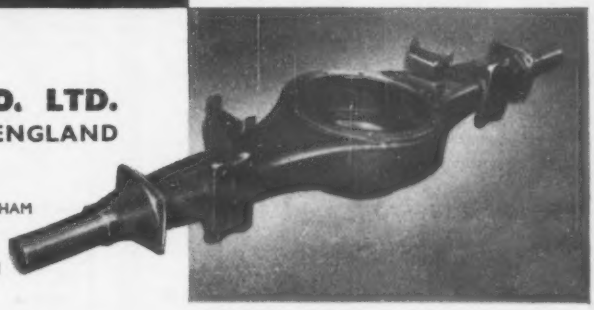

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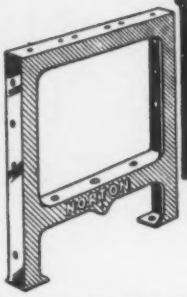

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Electrical Aids in Industry

Data Sheet **No. 2**

Induction Heating-1

Electro-magnetic induction was discovered by Faraday and used by him to evolve the electric motor. In some cases, induction can be a nuisance by causing heat losses to arise from induced eddy currents in near-by pieces of metal, but in industry today those heat losses are being turned to good account as a method of metal heating.

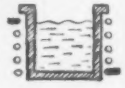
Induction heating produces heat only in the work piece. This is a fascinating and spectacular process which has the additional merit of being extremely effective. An important feature of induction heating is that it gives rapid temperature rise with no time lag, starting being instantaneous. Perhaps its greatest advantages are that it can be used in automatic processes and does not demand skilled labour.

Induction heating can deal efficiently with all the applications outlined below, and including metal melting, preheating and stress relieving, surface hardening, heating of large components, preheating of steel tubes for manipulating, heating for shrinking, for forging and extrusion, as well as for the heating of vessels. There are various methods of applying it, the method to be used being dictated by the application.

Technical details relating to the choice and use of individual types of induction heating will be set out in a subsequent data sheet.

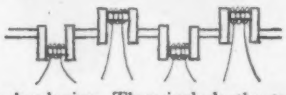
Metal melting

The oldest and largest application of induction heating lies in the melting of metals. The outstanding advantages are: freedom from deleterious gases and products of combustion and other contaminants, rapid speed of melting, low running costs, improved working conditions and reduced metal loss.



Metallurgical processes

This covers a large variety of processes which may be basically divided into surface heating and through heating. Most processes fall into the former category and are used for the purpose of



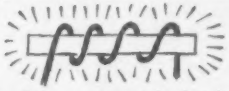
skin hardening. They include the treatment of such components as: pins, camshafts, crankshafts, rollers, cylinder liners, gear teeth, rocker arms and shafts and valve stems.

Through Heating

When the current in an induction coil is maintained for a longer period it results in the heat engendered in the work piece penetrating to a greater depth and eventually throughout the piece. It is largely used for the heating of slugs and billets for upsetting and upset forging, flanging and nosing, shearing and forging and bolt blanks for heading.

Annealing

Induction heating is the ideal method of altering the character of metals for a special purpose. Annealing and its related process of tempering, normalizing and stress relieving are prominent in this category. In the case of annealing, one



feature of the treatment is that it can be localised, while induction tempering can do in one minute what would require half-an-hour or more with conventional furnace heating.

Brazing, soldering and welding

Brazing and soldering by induction are the quickest and cleanest methods of joining metals together, and it is often beneficial to re-design the parts so that the fullest advantage can be taken of induction heating. Brazing can be used in the case of: carbide inserts for tools, tips for rock drills, parts for universal joints, etc., while the many applications of soldering are well-known. It was not until well into the present century that the age-old craft of welding became a positive aid to greater productivity. Induction welding produces a good, clean weld because oxidation is almost absent.

Miscellaneous applications

Induction heating can be profitably used for a large variety of purposes, including the fusion and hot pressing of powders, heating *in vacuo*, gas determination in metals, fusion of glass, chemical work and many other processes.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association.

Excellent reference books are available on electricity and productivity (8/6 each or 9/- post free) — "Induction and Dielectric Heating" is an example.

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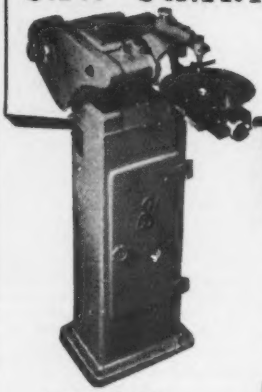

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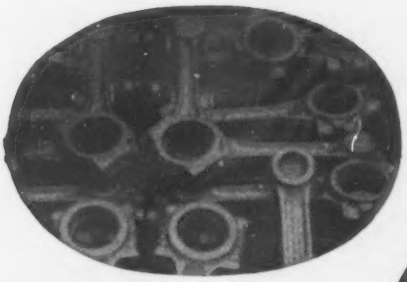

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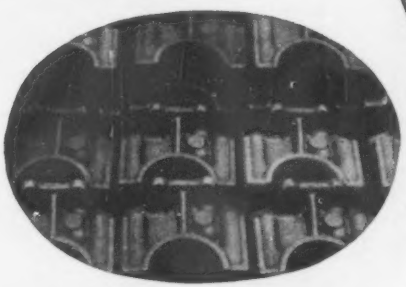

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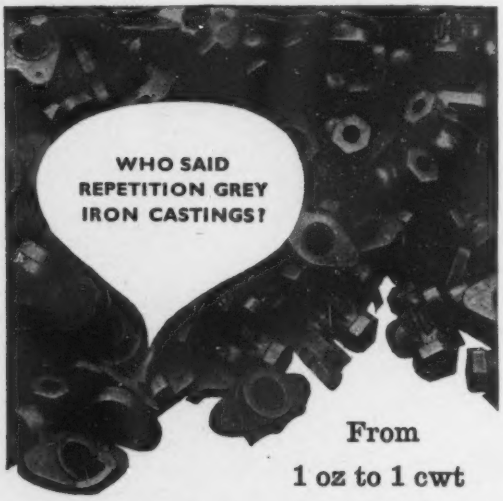

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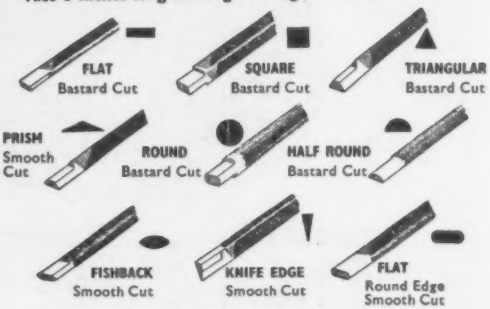

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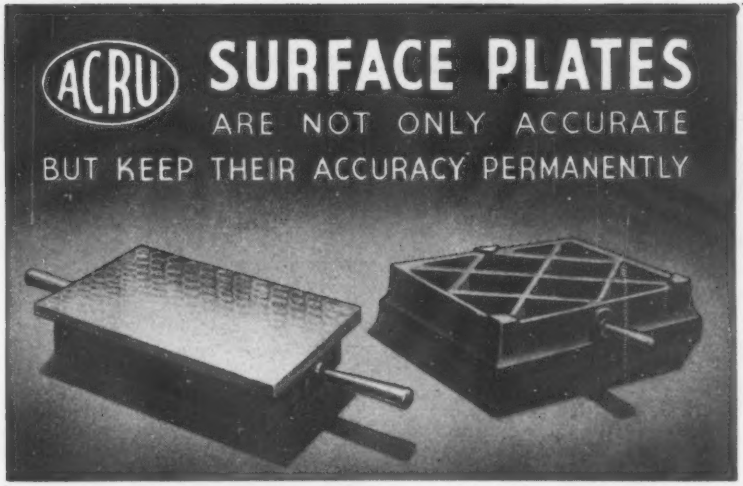

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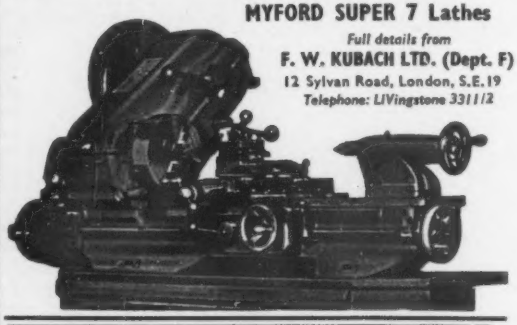

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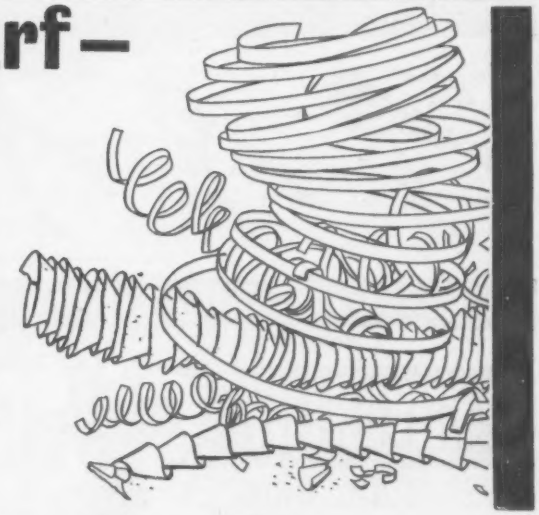

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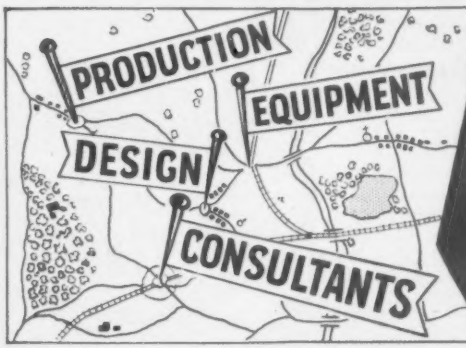

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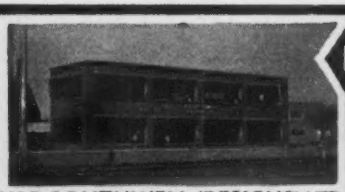

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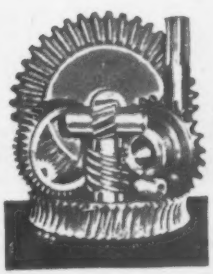

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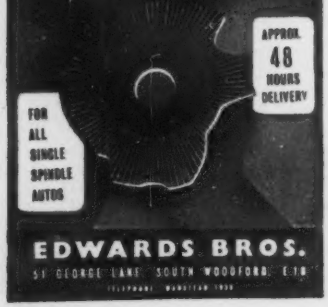

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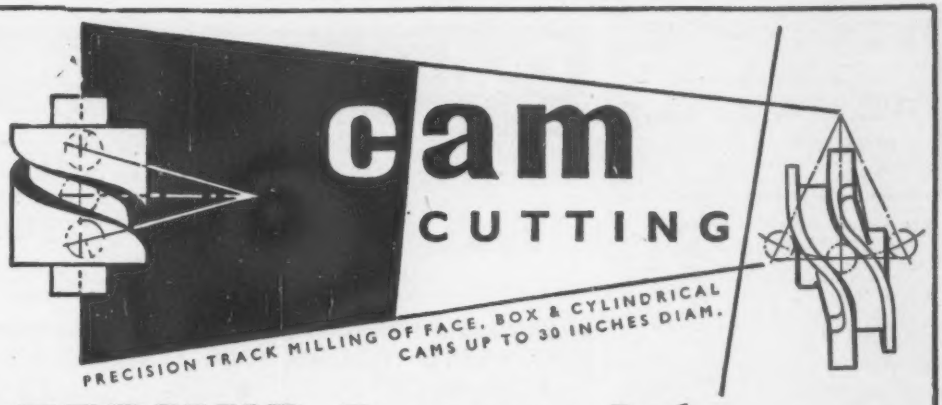

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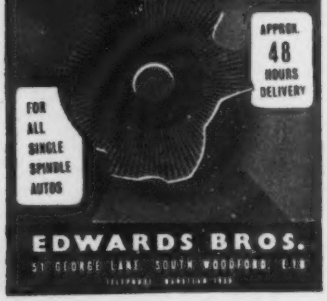

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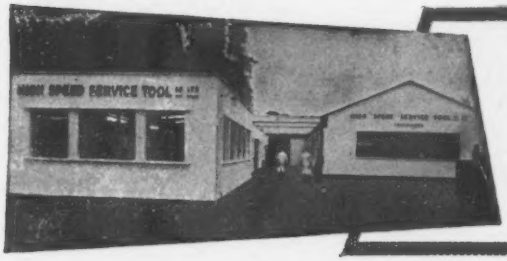

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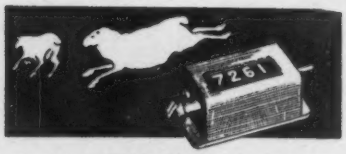

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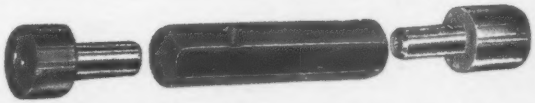

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BROWN & SHARPE No. 2 Vertical Miller.
CINCINNATI No. 2 Vertical Miller, dial type.
ARCHDALE 12in., 18in., 24in. and 30in. Vertical Millers.
CINCINNATI O8 Auto Cycle Millers.
KENT OWEN 1-14 Miller.
ARCHDALE 28in. Horizontal Miller.
RICHMOND O3 Universal Miller, 38in. by 9in.
EDGWICK No. 2 Simplimill, 37in. by 12in.

CLEVELAND 2¼in. Automatics.
HERBERT No. 5 Auto., 18in. by 3½in.
CONOMATIC ¾in. 4-spindle Automatic.

ASQUITH 5ft. Radial Drill.
KITCHEN & WADE 4ft. 6in. Radial Drill.
ARCHDALE " O " Multi Drill.
POLLARD 12X Multi Drill.
HERBERT Type V Drill.
POLLARD 4-spindle Sensitive Drill.
JONES & SHIPMAN ½in. Tapping Machines.

ORMEROD 26in. Slotter.
BETTS 12in. Slotter.

OSTER 6in. Screwing Machine.

SNOW NC14 Face Grinder, 12ft. stroke.
HEALD 72 Sizematic Duplex Internal Grinder.
CHURCHILL HBB Automatic Internal Grinder.
CHURCHILL 8in. by 16in. Semi-Universal Grinder.
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CHURCHILL 12in. by 36in. Universal Grinder.
BROWN & SHARPE No. 2 Surface Grinder.
SNOW 24in. by 8in. Surface Grinder.
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NEWALL 10in. by 48in. Model L.A. Hydraulic Cylindrical Grinders.
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WARD 2A Capstans.
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LANDIS 10in. by 18in. Plain Grinder.
CHURCHILL 24in. by 10in. Universal.
JONES & SHIPMAN Fig. 138 10in. by 27in. Universal Grinder.
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HERBERT No. 7 Turret Lathe.
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ARCHDALE 20in. Horizontal Mills (3).
ARCHDALE 28in. Horizontal Mill.
RICHMOND VHM Vertical Mill.
New VICTORIA V2 Vertical.
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HELLER Automatic Thread Millers (4).

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TAYLOR & CHALLEN B.1½ Non-inclinable Power Press, 10 tons pressure, blanking stroke ½in.

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WARD 3A and 7 Capstans, Bar feeds.

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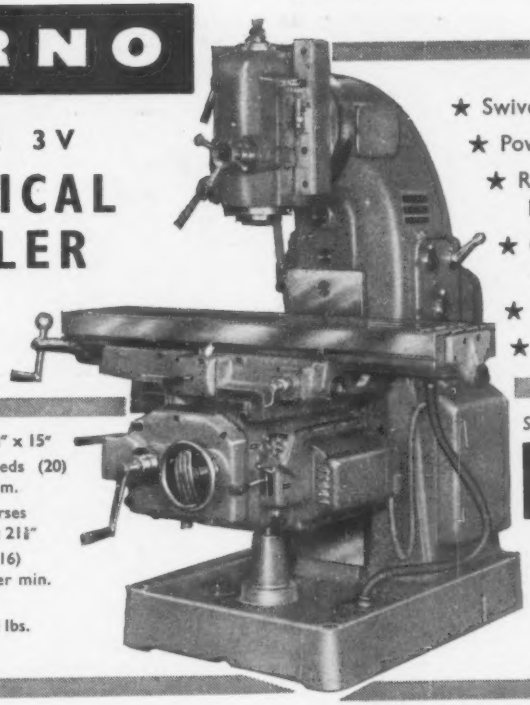

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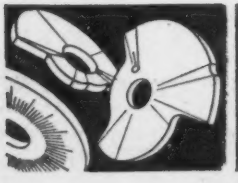

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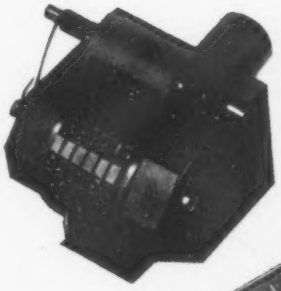

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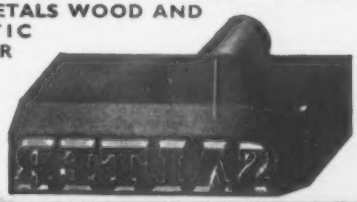

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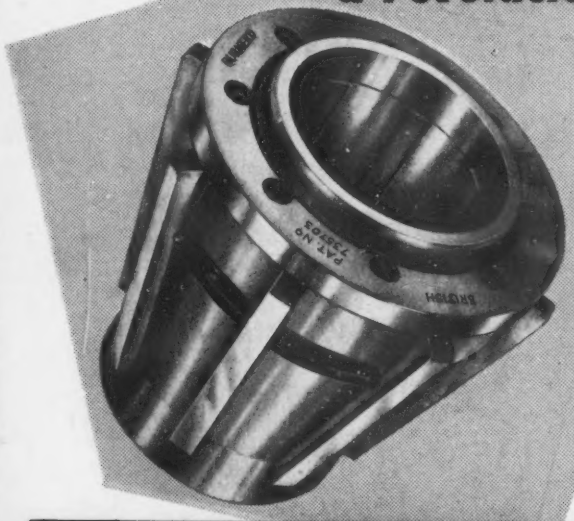

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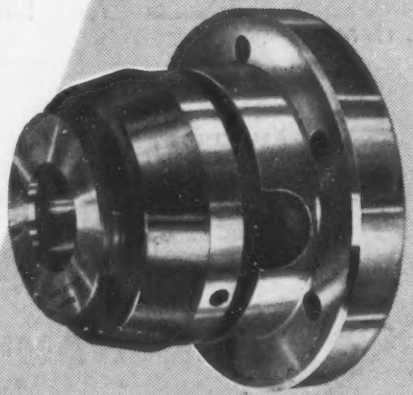

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